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ADDRESS AT THE ANNUAL GENERAL MEETING
of the Society held on 24 June 1935, by the President

MAJOR-GENERAL SIR P. Z. COX, G.C.M.G., G.C.I.E., K.C.S.I.

BEFORE I embark upon a review of the main happenings of the year let us, according to custom, pay brief tribute to the band of fellow-pilgrims who have passed on to the Elysian fields since our last Annual Meeting.

It is but natural, I suppose, that an Institution enjoying so regular a life-history as ours now does, should have attained such a degree of precision in its estimates of annual receipts and expenditure-under-various-heads, that, in the absence of any particularly abnormal condition, the figures differ extraordinarily little from year to year. Among these figures is the tale of mortality among Fellows, which stands at about 2 per cent. of our total strength, and this year calls for no special comment. But whereas last year the list included a rather unusual number of individuals who had figured prominently on the record of the Society, this year we are more fortunate. Obituary notices regarding those few to whose passing I will now make allusion have already appeared in the pages of the *Journal*, so that I can be very brief in my remarks.

The names of two of them will be found in the list of Honorary Members—distinguished foreigners on whom the honour was conferred, not for any close association with the work of the Society but because, as prominent men in their own countries, they figured on some special occasion with which this Society was associated.

Thus, *Marshal Lyautey*, the famous French soldier-administrator, who achieved in Morocco the same great reputation among his countrymen as our own Lord Cromer did in Egypt. Honorary Membership was conferred on him on the occasion of the Centenary of our sister Society in Paris. The great Marshal only paid one visit to this Institution: that was in 1931, when he presented us with his portrait as a memento of the occasion.

The second Honorary Member referred to was the Swedish Scientist Professor Wilhelm Wallen, who received the honour when he represented the Swedish Geographical Society at our own Centenary celebration in 1930. He had a considerable reputation in his own country as a meteorologist and

hydrologist, and was especially distinguished for his researches into the origin of floods and storms and the reactions of man to climate.

Now come five Fellows who have passed over.

Professor G. F. Scott-Elliot, who joined the Society in 1895. He was for some of his later years Professor of Botany at the Glasgow Veterinary College, but he was a man of such a retiring character that few of his acquaintances were aware of his exploring activities in the Ruwenzori region of East Africa in his earlier days. His chief contribution to Geography was a book entitled 'A Naturalist in Mid-Africa.'

Dr. Mary Newbigin was a very gifted and attractive personality. At the time of her death she was Editor of the Magazine of the Royal Scottish Geographical Society, with which she had been associated for upwards of thirty years, and by which her services to Geography were recognized by the grant of their Livingstone Gold Medal.

Mr. Michael Corbet Andrews was an Irishman of Belfast, and a keen student of the history and development of maps. He had a remarkable flair for discovering valuable specimens in out-of-the-way libraries and unexpected places. In accordance with his wishes his wife and sister were good enough to present the whole of his collection to the Society and arrangements have since been made to alter one of the rooms in the building so as to form a convenient home for the collection and a quiet study for students.

Mr. Frank Cana had been a Fellow for thirty-four years. He was a journalist by profession, on the staff of *The Times*, and for many years used to review books for the *Journal*. He was President of the Kosmos Club from 1929 to 1931.

Lastly, *Mr. H. G. Ponting*. He must, I think, have been well known to nearly all of us, if not in person, then by his beautiful photographs. It will be remembered that he was the photographer of Captain Scott's last expedition and brought back a wonderful series of antarctic pictures.

I now turn to what I may term our "exploratory" interests, and will deal with them in three categories:

(*a*) Expeditions which have returned during the year.
(*b*) Expeditions which have just set out or are just about to.
(*c*) Expeditions which are still away and from which we are receiving periodical news-telegrams through the newspapers who contracted for them.

In respect of the seven expeditions which I shall speak of in the first category, we have had interesting accounts in this hall from the leaders of six, and we look forward to welcoming the seventh, *Mr. W. B. K. Shaw*, early in our next Session. In all of them the Society showed its interest and afforded its support either in the form of modest cash grants or by the loan of instruments. (You would be surprised at the number and value—over £3000—of the latter which we now have out on loan.) We are however insured against loss or damage.

Among the leaders of the said seven expeditions *Mr. Wilfred Thesiger* and *Mr. Eric Shipton* (by proxy) have just been recipients in your presence of Awards of our Society, and I need not repeat here the grounds on which those Awards were given. To Eric Shipton I shall have occasion to refer again in

a few minutes. Of Mr. Thesiger I will only add that it is delightful to me to think that a young debutant making his first entry into the Civil Service (in his case that of the Sudan) should have such a fine piece of work already to his credit before starting on his career. I am sure we cordially wish him all success.

The other five of this category are:

Lieut. Martin Lindsay, Royal Scots Fusiliers, who led the small but most successful "British Trans-Greenland Expedition 1934." Its purpose was to approach from the west and survey the mountain range between Scoresby Sound and Mount Forel on the east coast which Gino Watkins and D'Aeth saw from the air in 1930 but which has so far proved inaccessible on foot. The project entailed a crossing of the ice-cap by dog sledge approximately along latitude 70°, and then a sharp turn southwards along the inland fringe of the Range, a total distance of about 1000 miles. Its accomplishment required that everything should shape precisely "according to plan." The scheme thus possessed therefore a considerable element of risk, but the plan had been very carefully made and was efficiently carried out.

After all, "nothing succeeds like success," and that was triumphantly achieved in this case.

I now turn to *Dr. J. R. Baker's* interesting expedition to the New Hebrides group—the Island of Espiritu Santo, to be particular. This was another of the expeditions fathered by the Oxford University Exploration Club. Its objects were to explore and survey as far as they could the neighbourhood of the highest range of mountains in the island; to study the fauna and its breeding conditions in a climate which hardly changes at all from one end of the year to the other, and finally to get all the opportunities they could for studying the character and customs of the natives at close hand. An interesting feature of this expedition was that members of the fair sex were included in the personnel and played a valuable part in facilitating friendly intercourse between the expedition and the natives.

Next I would touch upon the recent short expedition carried out by *Mr. Wordie and Dr. Longstaff*, of which Mr. Wordie gave us a most valuable account last Monday. Their plans were quite elastic, their primary idea being to visit Ellesmere Land and then pass on through the Canadian Arctic as opportunity offered, using their ship, the S.S. *Heimen*, as their base. The measure of their success depended on the ice conditions prevailing, and these proved, unfortunately, unfavourable alike to their plans and to those of the British Ellesmere Land Expedition, to which I shall shortly refer. These conditions prevented their making Cape York as they had hoped to do. This was of course a great disappointment to them, but they usefully occupied their time in exploring the Baffin hinterland and the mountainous region on the west coast of Greenland.

Mr. W. B. K. Shaw, who, it will be remembered, received the Gill Memorial Award last year for his work in the Libyan Desert with Major Bagnold, did not allow the grass to grow under his feet—not a very self-denying ordinance in the Libyan Desert, I imagine—and was soon off again for further research in that region. He has only returned quite recently, and we hope to have a paper from him at the beginning of next Session.

The last "returned expedition" that I have to touch upon is that of *Mr. V. E. Fuchs* to the Rudolf section of the Great Rift Valley. This did not, alas, share the good fortune of the other expeditions to which I have referred, but was brought to a sudden conclusion by the tragic loss, undoubtedly from drowning, of two of its members: Dr. W. Dyson, the young medical officer and zoologist of the expedition, and Mr. W. R. Martin, the surveyor of the party, who was an American citizen. It will be remembered that for use on the lake during their exploration the party carried a collapsible wooden boat with an out-board motor attached, as approved by the Air Ministry for use with flying boats, and recently used on the British Arctic Air Route Expedition. Probably no better boat for the purpose could have been devised, but I fear it was a case of the pitcher being broken at last, for undoubtedly what happened was that on one of their trips between the island and the shore they must have encountered one of those sudden storms of wind which get up so quickly on Rudolf and which swamped the boat and cost the two comrades their lives.

Every possible effort was made to search for the lost Englishmen or any traces of what might have happened to them, but eventually the search had to be abandoned as hopeless. Apart from this calamity the expedition was doing valuable work, and on the evening, in this Hall, when Mr. Fuchs gave us an account of the expedition, a resolution expressing deep sympathy both with the parents of the two lost explorers and with Mr. Fuchs on the tragic fate of his comrades was passed by the company present.

I will now touch upon the enterprises which have recently left the country or are on the point of doing so.

Firstly, *Mr. Augustine Courtauld and Mr. L. R. Wager*. They are just leaving for important work in East Greenland. The former has seen his way to charter the *Quest*, which will carry both his party and Wager's, and during the remainder of the summer they will jointly occupy themselves with the further exploration of the mountainous tract between Scoresby Sound and Mount Forel. Courtauld will return to England at the end of August, leaving Wager and his companions to winter there to complete a year's intensive work at the geography and geology of the Kangerdlugsuak region.

Then *Mr. A. R. Glen*, who you will remember has just been awarded the Cuthbert Peek grant for his work in Spitsbergen last year, is leading another Oxford University expedition to the same area, in particular North East Land, for serious scientific work in the direction of survey, the study of refraction, glaciology, and the conditions of radio-reception. He has a very strongly equipped party of nine, of the average age, be it noted, of twenty-three, and he has been particularly fortunate in securing the services of two military officers, Lieut. A. S. Godfrey, of the Royal Engineers, who did such good work with Martin Lindsay on the journey across Greenland which I have referred to this evening, and also an officer of the Army Signals.

I should like to take this opportunity of paying grateful tribute to the cordial co-operation which the Society experiences from the high authorities of the three fighting services, in the direction of making it easy, wherever possible, for young officers whose services are sought for serious expeditions to obtain special leave in order to enable them to participate.

It is an evidence of sympathy with exploration which we have great reason to appreciate.

Then again, our tried campaigner, *Mr. Kingdon Ward*, and *Mr. Ronald Kaulback*, who shaped so well when he accompanied the veteran on his expedition to the South Eastern Himalayas in 1933, are both back in the same part of the world: the former in pursuit of his botanical and geographic activities, and the latter, travelling quite independently, seeking fresh untrodden fields to explore.

My last item in the category of expeditions which have just set out or are about to do so is the Mount Everest Expedition 1935–1936. I have left that to the last as I have most to say about it.

In my address at the Annual Meeting last year I had a good deal to say on the subject of Everest and I do not want to victimize you by repeating it here; but if any one of you has sufficient interest in the subject I would ask him to look up my remarks in the *Journal* for August 1934. I there reviewed the history of the project and our attitude towards it and explained that alike on national, geographical, and other scientific grounds we had decided that we must continue to support it and that it must be pursued relentlessly to a finish by British mountaineers.

It is certain from the numerous applications that we get from foreign climbers to take part in an expedition, when they know that we are organizing one, that were we to abandon the ambition, the mountaineers of other countries would at once enter the field. I concluded my observations last year by saying that the first duty of the new Mount Everest Committee which was being formed should be to ensure that no opening should be missed for seeking permission for another attempt, "as the opportunity often comes when least expected." As a matter of fact we then feared that another opportunity was not likely to present itself for some years to come; we were the more surprised and pleased therefore when we received through the Government of India and their agent in Tibet an intimation to the effect that, if application were made at once, the Tibetan Government would be pleased to give permission for a new expedition. It has been decided by the Committee that the present attempt shall proceed on somewhat different lines to the set routine of the last three. A small party has just recently been sent out under the leadership of Eric Shipton (who was a member of the last expedition and who has just been awarded the Gill Memorial grant for his fine accomplishment around Nanda Devi last summer) to carry out a reconnaissance of the western approaches to the mountain and if possible to study the post-monsoon conditions prevailing on the mountain itself. At the same time the services of Major C. J. Morris (who lectured to us just recently on his travels in Bhutan and knows the Nepal people and languages) have been secured for making contact during the summer with the Nepalese authorities and getting in touch with the Sola Khombu element among the porters. It was they who rendered such fine service with previous expeditions. Sad to say, some of the most valuable individuals among them lost their lives in the tragedy of the German expedition to Nanga Parbat last summer. Our main expedition will be ready for the start next spring, and I am glad to say that in response to the Mount Everest Committee's invitation Mr. Hugh Ruttledge has agreed to take the lead again.

My third category covers those expeditions which are still away and from which periodical wireless despatches are being received by the newspapers who contracted for them. Those that I had in mind were, in the Arctic, the "Oxford University Expedition to Ellesmere Land" and in the Antarctic "The British Graham Land Expedition."

The former, which was organized by Edward Shackleton and is led by Dr. Noel Humphreys, met with the same bad luck in the matter of ice conditions as did Mr. Wordie. But after wintering at Etah they have been doing useful work since the season opened, in three parties, and have now returned to Etah to await a ship to bring them and their collections home. Their last message told us that the crossing of Ellesmere Land had been completed, Grant Land penetrated, and a new range of mountains of an estimated average height of 10,000 feet discovered to the north of the United States Range; results apparently both satisfactory and important.

The British Graham Land Expedition, under the command of John Rymill is, as you know, a project of great—indeed of national—importance. The party are at present settled down for the winter at their base on Argentine Island, and the last news despatch from them said that they were nevertheless fully employed getting their gear in order and that the leader was busy amplifying his plans for the spring.

All seems well with both parties.

Before I leave the subject of these expeditions I would like to make a few observations with regard to the position of this Society towards them. I find that there is sometimes a good deal of misconception prevalent both among members of the public and also of the Press, as to the extent of the Society's moral and financial responsibility towards those expeditions to which it has given its blessing and support. I wish to make it clear that the Society can neither claim nor shoulder such responsibility. For many years no expedition entirely of the Society's own, as it were, has left the country, and short of that phenomenon, responsibility rests on the individual who submits the plans to the Society for comment. Such plans are studied by the Expedition Committee, and if they appear sound and practicable are commended by that Committee to the Council for the support of the Society. In that case a small grant of money or the loan of instruments probably ensues. But such grants are unfortunately very small, as a rule, for our annual budget allotment for this purpose is only £450 or £500 altogether, and this, together with the interest of two small funds, the Expedition Fund and Penruddocke, has to be distributed between some seven or eight expeditions. In a very exceptional case like the Graham Land Expedition, which is regarded as practically a national one, it was felt that an unusually generous contribution was called for *pour encourager les autres*, but to make that possible the grant had to be spread over the budgets of three consecutive years, and this accounts for the small paper deficit appearing in this year's budget. But these indications of interest and support place the Society in no position of responsibility with reference to an expedition so assisted.

So much for our exploratory interests. Let me turn now for a few moments to the subjects of the lectures we have had during the past Session. As you know, we endeavour to get papers read by travellers as soon after their return

to this country as possible, but subject to that principle of policy we try to arrange a reasonable variation in the character of lectures from the picture point of view and otherwise. A Fellow said to me the other day that he thought we had had rather an undue proportion of the snow and ice element in our recent lectures. But there is not really much ground for that. Taking the total of Evening and Afternoon Papers delivered and films shown at 25, 8 out of the 25 have been of the category complained of; while if you take the evening lectures alone the proportion is 4 out of 10. We cannot get over the fact that the most promising fields for exploration and research nowadays are the mountain regions of Asia and the Polar Regions.

In addition to papers read by leaders of returned expeditions, we have had interesting papers from two foreign geographers who were good enough to come over here to deliver them. I refer to Captain Gabel Jørgensen's "Rasmussen Memorial Lecture," if I may so call it, and the Swedish Professor Hans Ahlmann on "Ice-Cap Studies and Glacier Physics." I take pleasure in expressing appreciation here of the ready and valuable co-operation and advice rendered by Professor Ahlmann when here to the Glen Expedition just mentioned.

Again, among our afternoon lectures we have had a fairly varied selection, *e.g.* The Study of Threatening Glaciers; Population Maps; the Domesday Geography of Norfolk and Suffolk; An Inland Water Survey, etc.

I must not leave this subject without special reference to our Jubilee Lecture. Situated where we are, off the processional routes, there was not much that we could usefully do as a Society to display our loyal devotion to Their Majesties and our desire to enter to the utmost of our power into the spirit of the Jubilee Celebration. But what we did do was to submit a loyal address of homage and congratulation which was graciously acknowledged and the text of which will appear in the *Journal;* to have the building flood-lighted during the Jubilee period; and to arrange for a special Jubilee lecture, which Sir Halford Mackinder undertook to render, than whom no better qualified Fellow of the Society could have been found. His lecture, which was appropriately entitled "The Progress of Geography in the Field and in the Study during the reign of H.M. King George V," was delivered on May 13, and both the eloquence of its language and the excellence of its matter were very greatly appreciated by the large audience which assembled to hear it.

Among remaining outstanding events of the year I should not omit to mention the Meeting of the International Geographical Congress at Warsaw in August 1934. Our ex-President, Sir Charles Close, F.R.S., headed the British Delegation, and in the course of the proceedings was invited to assume the Presidency of the next triennial Meeting, in succession to Dr. Isaiah Bowman, who presided at Warsaw. I myself attended simply as a Member of the Conference, hoping to imbibe some modicum of geographical learning from the pundits of all nations assembled there to instil it. I found a good deal of interest in some of the lectures and more especially in the exhibition of maps, ancient and modern, arranged for display at the Conference. I was particularly interested to note that the lectures concerning humanistic aspects of geography were the best attended of any. I imagine that this was to be accounted for partly by the fact that the more academic aspects of

geography are getting a stronger hold, and partly because those lectures were of a type more easily understood of the non-specialist element at the Conference.

I should mention too, as an important event, the opening of the Scott Polar Research Institute at Cambridge under the direction of Professor Frank Debenham. It was a very nice ceremony, eloquently presided over by Mr. Stanley Baldwin, and the Institute will surely become the authoritative centre for the concentration of information and lively interest in Polar problems of every kind.

A few words more in regard to our domestic affairs and I have done.

There have been two changes in personnel during the year. Firstly the resignation of the Chief Clerk, and secondly the relinquishment of his post as Assistant Editor by Mr. Shawe-Taylor, who had filled it very satisfactorily for four years past. It is accepted that it is in the Society's interest that this post should not be regarded as at all a permanent one. It can best be filled by a highly educated young man whom it will suit to take it for a short period of years, wherein to gain useful experience and prepare himself for a more permanent career. The new incumbent, Mr. Martin Cooper, who was educated at Winchester and Oxford, has settled down quickly to the work, to the satisfaction of the Council.

It will be realized, I think, that in these days of increasing speed and high pressure in all walks of life the work of the Society's Secretariat becomes heavier from year to year, and our distinguished Secretary is increasingly burdened with the constant necessity for interviews and the pressure of his correspondence as Secretary. Further than that, it will be remembered that he also functions, mostly out of office hours, I fancy, as Editor of our Publications, and in these days he is especially occupied in passing the material of the new edition of our well-known 'Hints to Travellers' through the Press. In order to make his position easier, the Council recently decided to establish a special Permanent Committee to be styled the "Publications Committee," composed of three Members representing different aspects of geography, which while maintaining as far as possible the advantages of single-handed editing will relieve the Secretary of some measure of the heavy responsibility which now falls alone on his devoted shoulders. Dr. H. R. Mill, Mr. J. M. Wordie, and Mr. Leonard Brooks have been invited and have kindly agreed to form the first Committee.

I am afraid my address has been rather a lengthy one; I can only hope that it has not been altogether devoid of interest to you. At any rate, I thank you very much for your patient hearing.

CONTRIBUTION TO THE PHYSICS OF GLACIERS: *A paper read at the Afternoon Meeting of the Society on 8 April 1935, by*

HANS WILHELMSSON AHLMANN

GLACIOLOGY is not only important for our knowledge of present-day glaciers, but is also essential for the proper understanding of the nature and activity of glaciers existing in the Ice Ages.

The investigations, of whose results I now have the honour to speak, began in 1920 in Jotunheim, the central high mountain district in southern Norway, and were continued more especially during the summers of 1923–25 on the small Styggedal glacier. In the summer of 1931 I was the leader of the Swedish-Norwegian Arctic Expedition to North-East Land and the surrounding waters, and in the summer of 1934 I accompanied Professor H. U. Sverdrup, when we both acted as leaders of the Norwegian-Swedish Spitsbergen Expedition. Both these expeditions were made possible by grants from the Swedish Government and the Norwegian Parliament. They were carried out absolutely according to programme and by the united efforts of the Swedish and Norwegian members. The general outlines of the 1931 expedition and most of its results are published in the *Geografiska Annaler*.[1] A review of the expedition will be found in the *Geographical Journal*.[2]

The expedition of 1934 [3] undertook a more concentrated glaciological-meteorological programme than the former, and had a Swedish and a Norwegian assistant as well as the two leaders. Our headquarters were on Isachsen's Plateau, a large firn-field in lat. 79° 9′ N., long. 12° 56′ E., and 850 m. above sea-level. Here we carried out the greater part of our investigations. Besides this I devoted myself to the Fourteenth of July Glacier, which goes down to Cross Bay on the west coast of Spitsbergen. We reached this glacier as early as June 19 without having seen any pack-ice in the sea. On the journey up to the plateau, which we reached on June 23, with 17 dogs and 3 sledges, I erected 22 bamboo stakes, each 2½ m. long, and put flags and numbers on each. During the summer these stakes were to serve as gauges for measuring the melting of the snow and ice and as signals for determining the movement of the glacier. The day after our arrival at our headquarters the sledge-drivers returned with 15 dogs to the coast and the Norwegian coalmine Longyearbyen; and they fetched us again on August 18. During our 53 days' sojourn on the plateau my assistant and I made two journeys down and up the Fourteenth of July Glacier with some light equipment specially constructed for this purpose, and this was drawn by the two dogs left with us. On the way back to the coast on August 18 the gauges were measured for the fourth and last time. On August 27 we were again in Bergen without having seen any pack-ice at all in the sea around Spitsbergen.

[1] "Scientific Results of the Swedish-Norwegian Arctic Expedition." Parts I–X (vol. i), *Geografiska Annaler* 1933. Part XI, *Geografiska Annaler* 1934. Part XIII (Vascular Plants from Northern Svalbard), Skrifter om Svalbard og Ishavet n:r 62, Oslo 1934. Part XII (Oceanography) will be published in *Geofysiske Publikasjoner* (Bergen) 1935.

[2] May 1934, pp. 420–425.

[3] The results will be published in *Geografiska Annaler* (Stockholm) and in *Geofysiske Publikasjoner* (Bergen) in 1935 and 1936.

As the Oxford Expedition in 1924 had already established, the plateaus of North-East Land are covered with typical glacier-caps. These are divided into three parts: the South Ice, the East Ice, and the West Ice. They belong to the group of glaciers which are geomorphologically characterized by extending in a continuous sheet in which the ice moves outwards in all directions. They differ from continental glaciers or inland ices in that they cover smaller areas. The second group of glaciers is characterized as confined to a more or less marked path which directs the main movement of the ice. Valley glaciers, trans-section glaciers, circus glaciers, and wall-sided glaciers belong to this group, as well as tongues afloat. As a third group I will include the movable masses of ice and firn, which spread in large or small cake-like sheets over the level ground at the foot of high glaciated regions. These glaciers, piedmont glaciers and foot-glaciers as well as shelf-ice, are not independent.

During my 350-km. sleigh journey across the three glacier caps, a pit about 2 m. in depth was dug at each camping place. Sections of three different types were thus exposed: one belonging to the ablation area, another to the accumulation area, and the third to a transition area between them. The firn-line, or climatological snow-line, which is of such great importance to our knowledge of glaciers, coincides with the boundary between the ablation and the transition areas. Such pits, which are very easy to make, thus rendered it possible to determine the altitude of this line without having to wait until it was revealed by the summer melt of the snow. On the North-East Land glacier-caps it was at altitudes varying from 350 to 550 m. above sea-level.

The area of the relatively best-known West Ice is about 2800 sq. km., 1600 of which are situated above the firn limit and 1200 beyond it. The thickness of the central parts of the three glacier-caps of North-East Land can hardly exceed 200 m., and they are probably 150–200 m. thick where they meet the sea.

The largest glacier-cap in Norway, the Jostedalsbrae (about 1000 sq. km.), is most likely much thinner. Over large areas the ice is certainly not more than 20 or 40 m. thick, and the topography of the surface of the ice sheet is influenced in detail by the rock surface underneath.

The object of my glaciological work has been to analyse the active physical processes, to investigate quantitatively the amount of snow, ice, and water passing through the glaciers, and on the basis of this knowledge to discuss the geophysical conditions of the existence and life of glaciers. In my opinion such investigations are absolutely necessary to acquire a more thorough knowledge of the geography of glaciers.

First of all I should like to treat ablation processes. While the amount and distribution of precipitation has long been carefully investigated and measured, ablation—by which I mean the joint result of the processes eating into the snow or ice surface, *i.e.* melting and evaporation—has not been made the object of any detailed study until the last few years. This is rather surprising, as ablation is obviously of as much importance in our knowledge of glaciers as are any other of the factors: accumulation, movement, etc., which have been closely studied ever since the first beginnings of glaciology.

Plate 1. A view of Sveanor, headquarters of the Swedish–Norwegian Arctic Expedition in 1931

Plate 2. The headquarters of the Norwegian–Swedish Spitsbergen Expedition in 1934

Plate 3. The ablatograph in use on Isachsen's Plateau

Plate 4. The margin of the Fourteenth of July Glacier in the fjord

Plate 4. The moraine of the Fourteenth of July Glacier in the fjord

For my preliminary studies[1] in the Jotunheim in lat. 60° 25′ N. and 1350 m. above sea-level I employed a first attempt at a recording instrument, an ablatograph. The amount of the ablation was determined at intervals of 8–10 hours and correlated with temperature, wind velocity, precipitation, and the values calculated of the radiation from the sun and sky. The observations covered 2515 hours. The total ablation during the whole summer at 1580 m. above sea-level was calculated for normal climatological conditions at 2000 mm. of water. During July and August the ablation amounted to a mean value of 2·3 mm. per hour for days and to 1·8 mm. for nights. The investigations resulted in a first general idea of the connection between the process of ablation and the meteorological elements. Heat convection by the air was found to have approximately twice as much effect on ablation as radiation.

A drawback to these investigations was the fact that the records of the meteorological elements had to be made some little distance from the glacier, *i.e.* about 1 km. from the ablatograph. Another disadvantage was the lack of continuous values of the radiation, which was due to the lack of a suitable actinograph.

At the headquarters of the 1931 expedition, Sveanor (Plate 1), in lat. 80° and 4 m. above sea-level, the records of the ablation were taken from June 30 to August 6 on a snowfield in the immediate vicinity of the meteorological station which was equipped with a recording actinograph of the Robitzsch's type. The observations cover 49 time-intervals aggregating 661 hours. During this time the total ablation amounted to 878 mm. of water, *i.e.* an average of 1·3 mm. per hour. I have estimated the total ablation at this place during the whole summer at 1400 mm. of water. On account of these observations A. Ångström made a preliminary equation for the relation between ablation and some of the meteorological elements most important to it: *i.e.* radiation, air temperature, and wind velocity. The result was that 40 per cent. of the ablation was due to radiation and 60 per cent. to heat convection by the air.

Even these investigations I consider have not reached the standard of necessary accuracy and completeness. The collaboration between Professor Sverdrup and myself during the 1934 expedition has now brought this problem much nearer its solution.

Professor Sverdrup's object during this expedition was a detailed study of the heat balance between the atmosphere and the snow surface. For this purpose we mounted at our headquarters an instrumental equipment to enable Sverdrup and his Norwegian assistant to determine from June 26 to August 15, for every hour of the day and the night, the meteorological elements from the snow surface to 5 m. above it with the greatest accuracy. About 20,000 readings were taken, thus giving him more extensive and accurate material than has ever been previously obtained on a glacier. At the same time Mr. Olsson, my Swedish assistant, made all radiation intensity measurements. My object was to ascertain the ablation, *i.e.* the effective result of the action of the heat, transferred to the snow surface by air and radiation.

For this purpose I employed an ablatograph (Plate 3), designed by Doctor

[1] "Physico-Geographical Researches in the Horung Massiv, Jotunheim." I *Geografiska Annaler* 1923; II–IV *Geografiska Annaler* 1927; (IV The Ablation); V–VI *Geografiska Annaler* 1928.

O. Devik in Norway at my request.[1] A recording mechanism is fixed on a firm support above the surface of the snow, and this registers the subsidence of a float resting on the snow or ice; the float is connected to the recording mechanism by a string. The support had no independent movement, the string did not stretch or slacken, and the mechanism worked perfectly. The float however had independent movement, as when the radiation was considerable it absorbed more heat than the snow and consequently melted into it. When the sky was overcast, and still more in foggy weather, the snow surface sank on the other hand more quickly than the float, if the latter had previously sunk into the snow. The level of the float in relation to the snow surface was therefore ascertained at least a couple of times a day, especially when the weather changed. Additional control was obtained too by measuring the ablation two or three times a day on a slender bamboo or other stake stuck into the surface close to the instrument. After making these corrections for the independent movement of the float, continuous curves of the subsidence of the snow surface were obtained, which permitted the determination of the ablation every two hours with an accuracy of 0·5 mm. (Fig. 1).

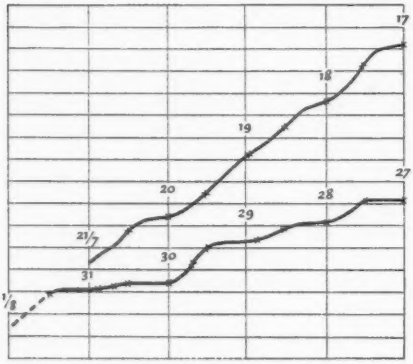


Fig. 1

The total ablation from June 26 to August 16 amounted to 415 mm. of water, or on an average 0·33 mm. per hour. The maximum for a two-hours' interval was 9 mm. of water. For the whole summer the ablation has been calculated at 480 mm. of water. Apart from this, 270 mm. of water remained of the snow accumulation from the preceding winter.

Professor Sverdrup's treatment of his meteorological observations is not yet completed,[2] but from what has hitherto been ascertained, it may be said that the results from the 1931 expedition have been confirmed concerning the much greater effect on ablation[1] of heat convection by air than of radiation. The air temperature was as a rule lowest at the surface of the snow and increased upwards. Consequently, a transference of heat generally took place from the air down to the snow, even when the temperature was negative. These observations also rendered it possible to determine in detail the importance of the humidity of the air for ablation. This is necessary for calculating the quantity of moisture condensed on the snow, when warm and humid air passes over it,

[1] The instrument, its technical use and the necessary corrections that must be made to its records are treated in: H. W:son Ahlmann, "Determination of the Ablation of Snow and Ice; Hyllningsskrift till Sven Hedin," 19 febr. 1935," *Geografiska Annaler* 1935.

[2] A preliminary report, "Varmeutvekslingen mellem en sneflate og atmosfaeren," is published in *Beretninger fra Chr. Michelsens Institutt*, Bd. V, Bergen 1935. The definitive treatise will be published in *Geofysiske Publikasjoner*, Bergen.

and the amount of evaporation when the air is dry. Professor Sverdrup has found that ablation is greatest in periods with warm and humid air, especially when wind velocity is great; in periods with warm and dry air ablation is much less. It will be remembered in this connection that the melting of 1 mm. of snow requires only one-eighth of the heat necessary for the evaporating of the same quantity. On the whole evaporation plays an unimportant rôle in ablation as compared with melting.

For studying the firnification of snow and the recrystallization of firn into ice we dug seven pits at our headquarters, five of which were 4–5 m. in depth. In the largest of them we bored another 10 m. with an auger specially constructed for this purpose.

In Figure 2 the sections of five pits are placed side by side and refer to the snow surface on June 25 at 8 p.m. We see that the firn is well stratified, which is due to the presence of a great number of horizontal ice layers in the sections marked in black. From this figure the following facts are obvious: firstly, even if an ice layer varies considerably in thickness, its base is horizontal; secondly, some ice layers are thicker and more continuous than others. The first circumstance is due to the fact that the ice layers are first established as relatively thin crusts, which have subsequently been increased by material from above. The second circumstance is due to the ice layers making the boundary between two accumulation periods, *i.e.* these layers have their origin in the ice crusts, which freeze on the snow surface during the autumn, after the summer melting, and are then covered by snow during the winter following. The correctness of this opinion is fully proved by facts, upon which I cannot however enter here. Thus the firn mass is very clearly laminated in annual layers, and I have marked the boundaries in question with the respective years during the autumns of which they were established as an ice crust on the snow surface. The profiles are therefore calendars, comprising the years 1924–34, in which every annual layer corresponds to the accumulation surplus of one year, *i.e.* the total accumulation of precipitation in solid form during the winter minus the ablation during the summer following. This surplus varies in the seven pits between 95 and 300 mm., the mean being 200 mm. of water. These numbers also represent the very important values of the yearly contribution of nourishment to the glaciers in this district of Spitsbergen.

The boring from 5 to 15 m. in depth showed that the same conditions prevail in that part of the firn mass as in the uppermost 5 m., *i.e.* during the period 1899–1934 the glaciers from Isachsen's Plateau have received an annual average of 200 mm. of water in the form of snow or firn.

I found exactly the same conditions in the accumulation area of the North-East Land glacier-caps. In these districts however the annual surplus of snow and firn was only 63 mm. of water on an average. This fact is closely allied to the circumstance that these glacier-caps are nearly dead or have at least only a very small activity.

Besides this I have systematically made microscopic investigations of the structure of the firn, determinations of its specific gravity, and its permeability of radiation. These investigations are not as yet completed.

Sverdrup determined the temperature and its variations every day in the

firn masses in several places at our headquarters, by means of electrical resistance thermometers. In consequence of the facts established in North-East Land in 1931 we had expected to find on Isachsen's Plateau, where the mean annual temperature is about −12° C., frozen firn down to a considerable depth. As early as on June 25, when the largest pit was dug and the melting had just begun, I found however that at 3 m. the temperature was the lowest (−6° C.) and from there it rose to zero at 10 m. Sverdrup's systematic records have led him to the following conclusions about the thermal conditions in the snow and firn.[1] When the ablation water penetrates down into the firn, it freezes when it reaches the depth where the firn temperature is negative; it gives off its freezing heat and makes the temperature rise lower down. Exactly the same process occurs when a frozen fish for instance is put in water to thaw: an ice-shell forms round the fish. On August 1 every trace of the winter cold had disappeared and the whole firn masses were at zero.

Sverdrup has calculated that 145 mm. of water freezes in this manner in the first 10 m. when the annual surplus of snow is 400 mm. The rest of the ablation water passes down through the firn and runs off.

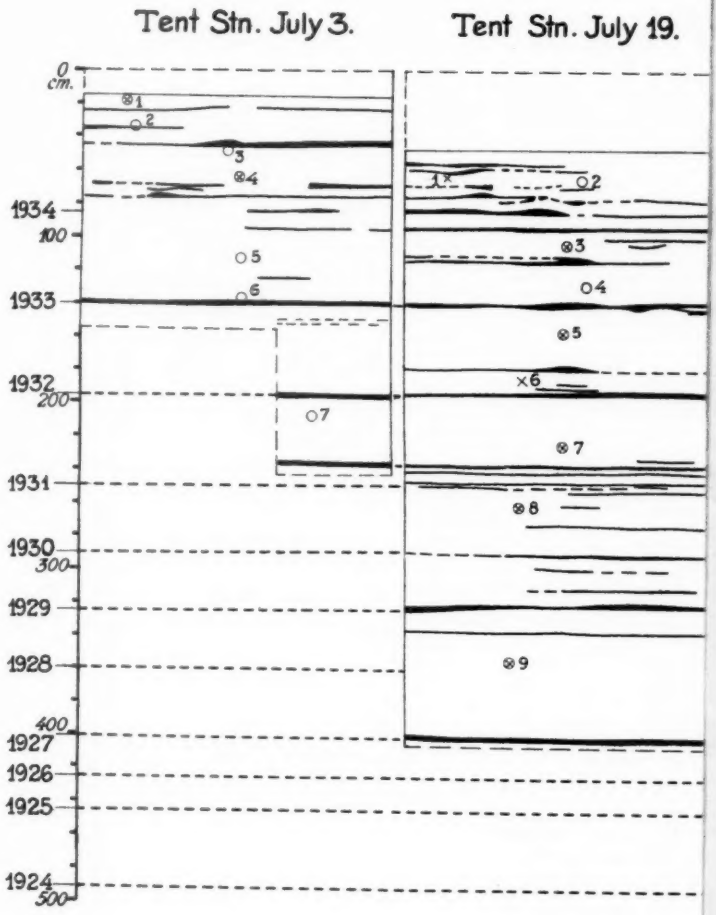
In consequence of these processes the ice crusts become thicker and the specific gravity of the annual layer of firn rises the lower we go. My measurements show that the density of the annual layers regularly increases from 0·54 in the layer 1933–34 to 0·64 in the layer 1924–25. This freezing process does not occur lower than 10 m., and Sverdrup believes that the transformation of the firn into glacier ice does not begin until the depth is so great that the pressure becomes the decisive factor. As a consequence of this freezing process a slow recrystallization of firn crystals will take place.

All these processes are of the greatest importance to our knowledge of glaciers. On the basis of the temperature observations made during my sledge journey over the glacier-caps of North-East Land in 1931 it has been calculated that under certain assumptions these glaciers are frozen to a depth of 270 m. at least. The glaciers with negative temperature, so important in the study of glaciology, were first discovered by Colonel J. P. Koch and A. Wegener in East Greenland during their expedition in 1912–13. The German Greenland Expedition Alfred Wegener continued these investigations at the station Eismitte in 1930–31. The results of these expeditions, our knowledge of Alpine glaciers, and various statements as regards the structure of glaciers in other parts of the Earth led me to classify glaciers geophysically as follows:

I. *Temperate glaciers* consist of crystalline ice formed by fairly rapid recrystallization of the annual surplus of solid precipitation. Throughout these glaciers the temperature corresponds to the melting-point of the ice, except in the winter time, when the top layer is frozen to a depth of not more than a couple of metres. The glaciers of Scandinavia and the Alps are included in this group.

II. *Polar glaciers* consist, at least in their higher and upper parts, of hard crystalline firn formed by slow recrystallization of the annual surplus

[1] H. U. Sverdrup, "The Temperature of the Firn on Isachsen's Plateau"; will be published in *Geografiska Annaler* 1935.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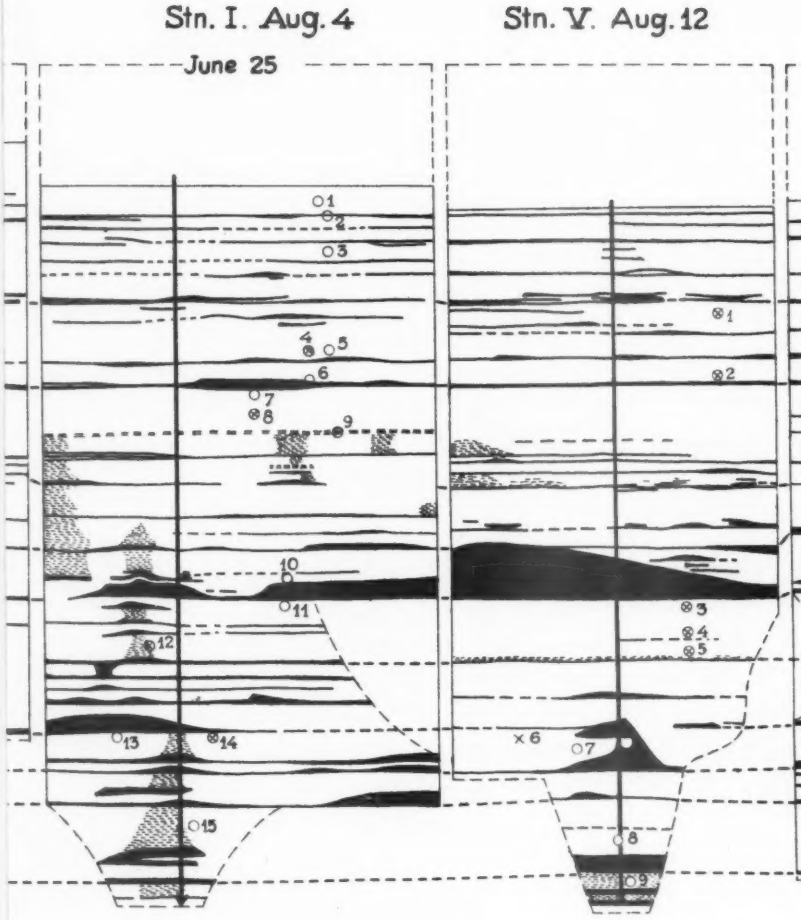
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Fig. 2.

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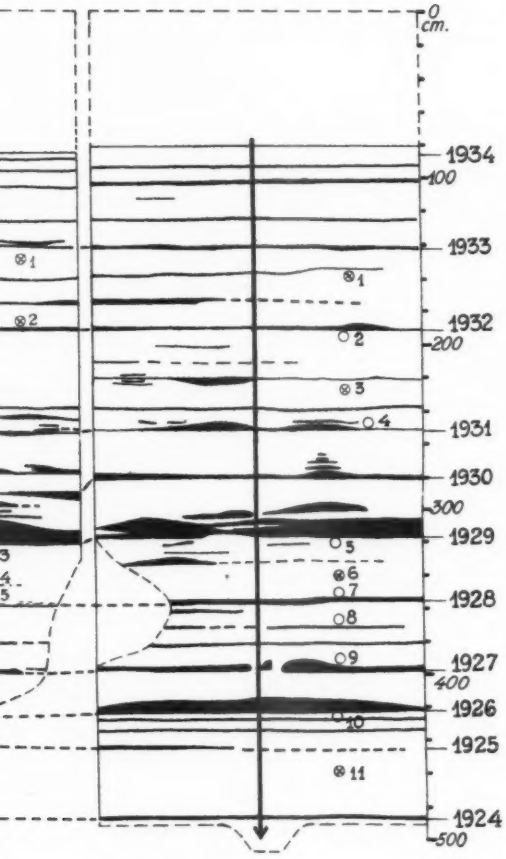

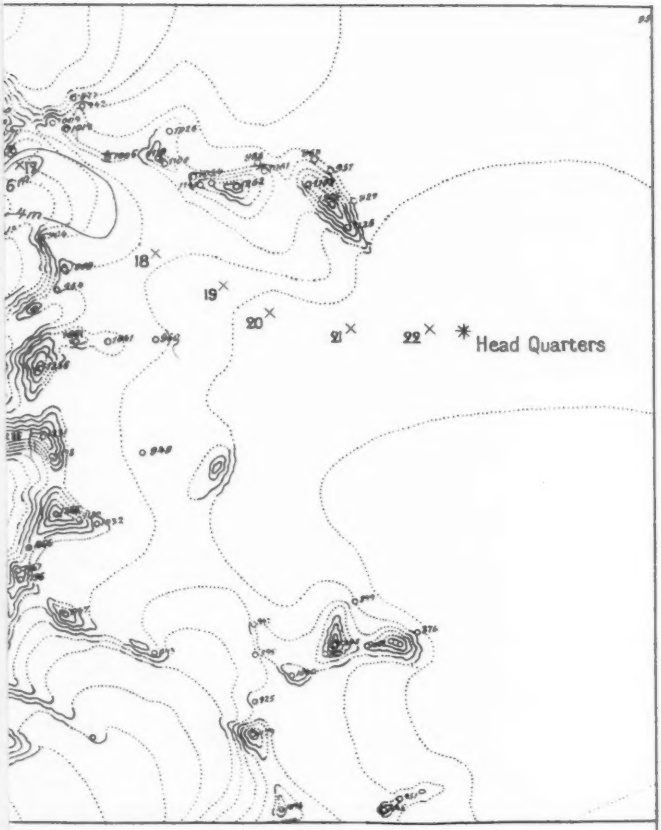

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conditions. The margin of the Glacier in the fiord on Aug. 19th 1934 in full outline, and on Isachsen's Plateau mark the gauges. Encircled crosses on side of the Glacier ark its movement in m. for 60 days from middle of June to middle of Aug. 1934.

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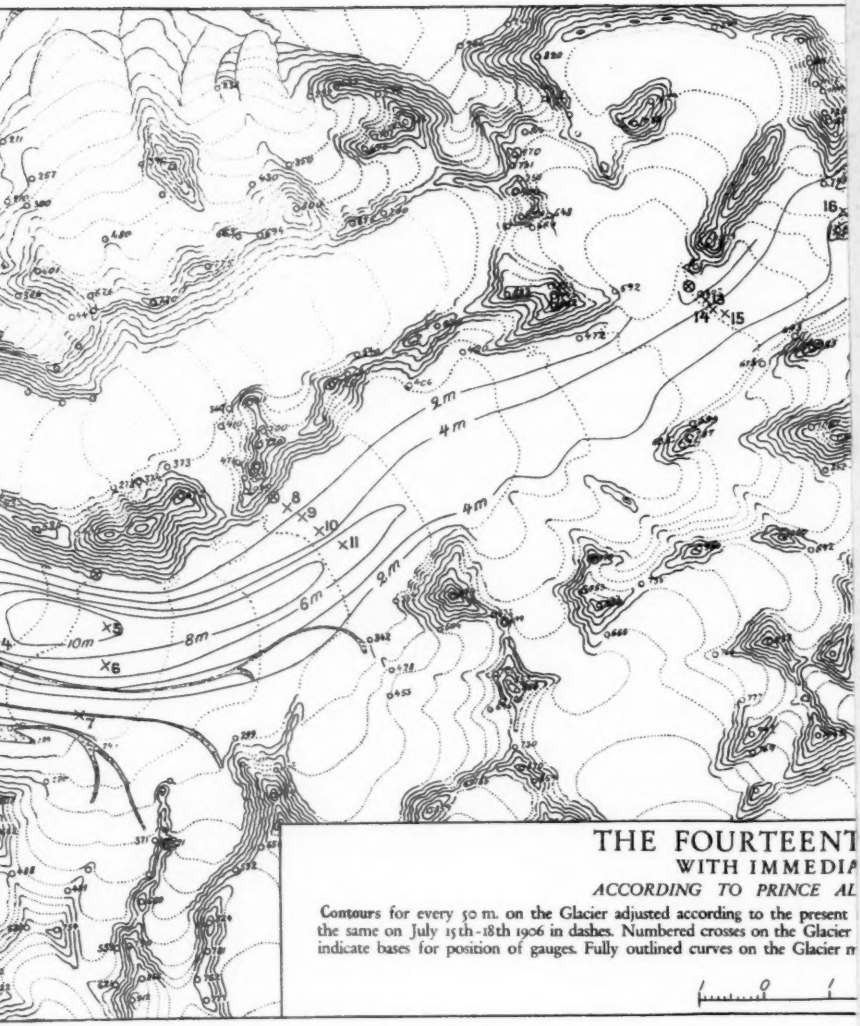

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Contours for every 50 m. on the Glacier adjusted according to the present
the same on July 15th-18th 1906 in dashes. Numbered crosses on the Glacier
indicate bases for position of gauges. Fully outlined curves on the Glacier m

0 1

Fig. 3.

of accumulated solid precipitation. The temperature of the glacier, at least in the accumulation area, is negative even in summer down to a depth of at least 100 m. or more. These Polar glaciers can be subdivided into:

A. *High-Polar glaciers*, which consist, at least in their accumulation areas, of crystalline firn to a depth of a couple of hundred metres or more. Even in summer the temperature in the accumulation area is so low that as a rule there is no melting accompanied by formation of water.

B. *Sub-Polar glaciers*, which in their accumulation areas consist of crystalline firn down to a depth of some 10 or 20 metres. In the summer the temperature allows melting accompanied by the formation of some water. This group includes the North-East Land glacier-caps.

This geophysical classification of glaciers is of course only a preliminary one, and it is only a first attempt to gain a broader and more rational survey than the morphological one, which principally refers to their external qualities and says very little about their most important characteristics, that is the physical ones.

It is undoubtedly correct that a close relation exists between the two essential physical qualities of the glaciers and the proportion of firn to ice, *i.e.* their temperature and their composition of firn and glacier ice. The temperature of the air, especially during the summer, is of great importance, not directly however, as this depends upon the quantity of ablation water, which it determines. In districts where the ablation water is sufficient to raise the negative winter temperature in firn and ice to zero, the glaciers are temperate and consist mostly of ice. In districts where the ablation water is not sufficient to make the winter cold disappear, glaciers are polar and consist mostly of firn. In these latter regions we must first mention the Antarctic, in which pure blue ice is very rare; in the second place we have Greenland, the inner and larger parts of which consist mostly of firn with very low temperature. Those portions of the Greenland inland-ice which consist of ice can also have a negative temperature, which is due to the ice being formed in the deeper parts of the central districts where the temperature is low; carried forward to the peripheral districts with ablation, it is difficult for the melt-water to penetrate the ice in the same manner as it can the porous firn, thus increasing its temperature to zero.

The investigations carried out at headquarters on Isachsen's Plateau formed the basis for the quantitative determinations of the material that pass through the Fourteenth of July Glacier, these being necessary in order to form an opinion of its character and life; the same holds good for every glacier.

Figure 3 is a copy of part of the excellent maps of N.W. Spitsbergen of the Isachsen Mission, 1906–07. Only the contours on the glacier have been changed in order to suit present conditions; the margin of the glacier in the fjord on 19 August 1934 and in August 1906 has been drawn as well as the curves showing the rapidity of the movement of the glacier during sixty days

from the latter part of June to the middle of August 1934 and from a maximum of 10 m. to zero.

The ablation determinations on the 22 gauges placed at different altitudes on the glacier and on Isachsen's Plateau, showed that ablation decreases with rising altitude and falling temperature, but that this decrease does not occur continuously. At the firn-line it drops, thus giving the curves the courses seen on Fig. 4. Ablation is much greater on snow-bare ice below the firn-line than on snow above this line, this being due to the fact that ice utilizes much more radiation heat than snow. This difference almost corresponds to the unequal albedo of ice and snow. The consequence is that ablation on a glacier, which has been long in recession or is dying and therefore comprises large areas of snow-bare ice, is more dependent on radiation than a glacier which advances or is in a stage of equilibrium and is thus covered by snow over at least two-thirds of its area.

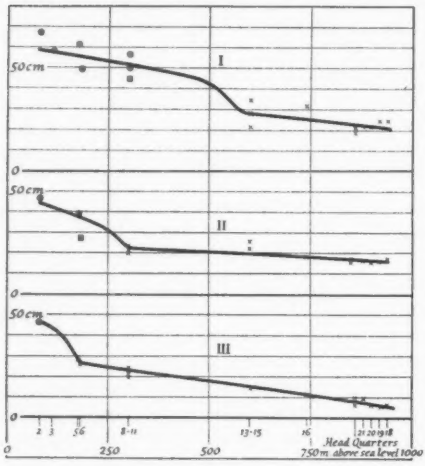


Fig. 4

After the last measures were taken on August 18 the ablation continued on the lower parts of the glacier right to the end of September, which was due to the exceptional heat of this month. For this period the ablation has been calculated with sufficient accuracy from the observations at the Norwegian Meteorological Station on Cape Linné. On August 18 the firn-line was at 550 m. above sea-level, but during the latter part of August it rose to 600 m., which is 150–200 m. higher than its normal position.

As a consequence of the determinations of the depth of the snow during the journey up to Isachsen's Plateau on June 20–23, and as a result of additional calculations, the accumulation of snow has also been determined on the whole glacier from the autumn of 1933 to the autumn of 1934. The curve representing this accumulation from sea-level to 1000 m. above it differs considerably from that of the precipitation. The reason of this is that during the winter the wind sweeps away large quantities of snow from the higher parts of the glacier and this accumulates on the lower and more sheltered portions. The quantity of material thus shifted is estimated at about 9,000,000 cubic m. of water.

In the same way, *i.e.* with the aid of the figures of the areas between the different contours, I have calculated the excess of accumulation above the firn-line and the excess of ablation below it. The result of this is that during the last season, 1933–34, the ablation surplus was about $4^1/_2$ times as much as the accumulation excess. The preliminary value of the former is about

53,000,000 cubic m., and of the latter 12,000,000 cubic m. of water. This incongruity between the accumulation and the ablation is so considerable that it cannot but prove disastrous to the maintenance of the glacier at its present size. These facts are not at all impossible, as last summer was characterized by such meteorological conditions that the firn-line, as has already been said, rose 150–200 m. above its normal position, and therefore an additional 13·5 sq. km. were exposed to the great ablation which always occurs on snow-bare ice. This also shows the very great importance of every change in the position of the firn-line, the decisive rôle of the ablation factors in these changes, as well as their effect on the whole life of a glacier. Most of the Spitsbergen glaciers have been receding for many decades and the conditions of last summer even brought this to a culmination.

The following data also confirm that the Fourteenth of July Glacier is at present in a very bad condition. Its margin has receded about 1000 m. since 1911 (Plate 4), the thickness of the ice had diminished 25–40 m. in the lower part, the movement of the whole glacier is slow, and some of its peripheral parts are dead or dying (Fig. 3).

As I have said before, warm humid air with a strong wind greatly contributes to ablation. Spitsbergen receives its supply of such air from the winds which blow from the northernmost part of the Atlantic Ocean, called the Norwegian Sea, the heat capacity of which is regulated by the Gulf Stream. The investigations of this stream, which Fr. Nansen and B. Helland-Hansen began and the latter continued, have shown[1] that its variations of heat quantity are so great, that these correspond to the unequal climatological conditions regulating the ablation on the Spitsbergen glaciers. When the capacity of heat increases in the Norwegian Sea, the frequency and force of the warm humid south-west winds on Spitsbergen also increase. The activity of the atmosphere connected with the heat conditions in the northern Atlantic may possibly explain the recession of glaciers, not only on Spitsbergen but also on Franz Josef Land and in Scandinavia; the very remarkable gradual death of inland ice on the northern island of Novaya Zemlya may also be attributed to this fact. If the continued analysis of last summer's observations can prove this, it may be possible to form a basis for a general discussion of the present glaciation on the Earth and its fluctuations.

It must be remembered however that the observations hitherto published by U. Monterin[2] on the ablation on the Lys Glacier on the southern side of Monte Rosa, lat. 45° N. and 2300–2500 m. above sea-level, most likely show that in this place radiation is more important than heat convection by the air.

It may be assumed that the variations of the heat capacity in the Gulf Stream are connected with the general circulation of the atmosphere of the Earth. In this case we come to a question similar to that which G. C. Simpson[3] has

[1] Björn Helland-Hansen: The Sognefjord Section. "Oceanographic Observations in the Northernmost Part of the North Sea and the Southern Part of the Norwegian Sea," James Johnstone Memorial Volume. Liverpool 1934.

[2] U. Monterin: "Recerche sull' ablazione e sul deflusso glaciale nel versante meridionale del Monte Rosa," *Bollettino del Comitato Glaciologico Italiano*, N. 11, 1931. Torino 1931–IX.

[3] G. C. Simpson: "World Climate during the Quaternary Period." *Quarterly Journal of the Royal Meteorological Society*, vol. lx, October 1934.

recently discussed theoretically. If the radiation from the sun increases, then the general circulation of the atmosphere as well as the activity and heat of the Gulf Stream will also increase; the south-west winds from the northern Atlantic will increase in strength, and ablation on glaciers will be greater in districts where melting is principally due to this heat supply by air, as well as in districts where it is mainly due to radiation.

This series of theoretical possibilities must however be regarded as only an hypothesis. We must first secure detailed glaciological material of the same character as this I have now mentioned from Spitsbergen and the North-East Land, in different climatological regions and on different heights round the Earth. In conclusion I should like to express the hope that the Royal Geographical Society has been sufficiently interested in my lecture to wish to support my suggestion.

Additional Notes

(1) After I had delivered this lecture my attention was called to an article by G. Slater ("Studies on the Rhone Glacier, 1927. The Relationship between the Average Air Temperature and the Rate of Melting of the Surface of the Glacier," *Quart. Journal of the Royal Meteorological Society*, vol. lv, October 1929). Concerning this article I only wish to say that analyses hitherto made (such as G. Slater, "Observations on the Nordenskiöld and neighbouring Glaciers of Spitsbergen, 1921," *Journal of Geol.*, vol. xxxiii, Spitsbergen Papers 1–32) between ablation and average *temperatures* cannot give any answer to the question of the dependance of ablation on the *meteorological* elements. First and foremost wind velocity, turbulence, and air humidity play such an important rôle that one must make the same consideration to these factors as to the air temperature. Further, it is not the mean air temperature but the high temperature during some hours or days that is most decisive for the amount of ablation. I am glad to see that Mr. Slater (on p. 392) has come to the same conclusion as I have concerning the necessity of locating the meteorological station, the records of which might be correlated with the ablation, right on the glacier. This was one of the objects of my expedition in 1934 and it was also fully realized.

(2) In 'Scientific Results of the Swedish-Norwegian Arctic Expedition in the Summer of 1931,' Part VIII: C (1933) I proposed that the glaciers from a geophysical point of view should be divided into *temperate glaciers*, *high-arctic*, and *sub-arctic glaciers*. These names have been changed in my lecture to *temperate glaciers*, *high-polar*, and *sub-polar glaciers*. When I wrote my treatise in 1932 I did not know the article of M. Lagally ("Zur Thermodynamik der Gletscher," *Zeitschrift für Gletscherkunde* 1932, 4–5). In this article he writes: "Man hat also für weitergehende Untersuchungen verschiedene Typen von Gletschern zu unterscheiden. 1. einen *kalten Typ*, der nirgends Schmelztemperatur hat; 2. einen *Warmen Typ*, der überall, von einer Oberflächenschicht mit schwankender Temperatur abgesehen, Schmelztemperatur hat; 3. einen *Übergangstyp* mit einer mehr oder minder dicken Schmelzschicht." It is with great pleasure that I have established that the principles of Lagally's classification fully agree with mine, and I think that they are of such a significant character that they will be of lasting value. Another question is the suit-

ability of the terms proposed, which subject can be decided by international discussion. My account of the relation between the fundamental thermal conditions and the different proportion between firn and ice in the formation of glaciers is also of only a preliminary character. I am convinced of the great importance of these circumstances for our knowledge of the nature of glaciers, but considerable additional investigations must certainly be achieved before the problem is solved.

(3) Professor Sverdrup emphasizes that, when discussing the relative importance of melting and evaporation, it must be borne in mind that the temperature of the snow (or ice) surface cannot rise above 0° C., and that the air which is in contact with the snow (or ice) has a temperature of 0° and contains an amount of water vapour which corresponds to saturation at the given air pressure. Furthermore, it must be remembered that the processes of evaporation and condensation do not depend upon the relative humidity of the air, but upon the specific humidity, the content of water vapour in unit volume. If the air is warm and wet, the content of water vapour increases rapidly with increasing distance from the surface, and, since the air motion is turbulent, water vapour is conveyed towards the surface where it condenses and the liberated heat is used for melting the snow. A snow surface will nevertheless appear almost dry since the melting water rapidly trickles down through the snow, but an ice surface will appear wet. If the air is warm and dry similar processes take place, unless the air is very exceptionally dry. At an air temperature of 10° the relative humidity must be less than 50 per cent., and at an air temperature of 15° the relative humidity must be less than 36 per cent., if the content of water vapour is to decrease with increasing distance from the surface. Even when evaporation takes place the effect on the ablation is small, since 680 gram calories are needed in order to evaporate 1 gram of snow or ice, but the effect of condensation on ablation is considerable, since condensation of 1 gram of water liberates 600 gram calories which are sufficient for melting 7·5 grams of snow or ice.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The paper this afternoon is a "Contribution to the Physics of Glaciers," and is to be read by Professor Ahlmann, Professor of Geography in the University of Stockholm. This study of glaciers he has made specially his own, and I am glad to see that there are present several who are specially interested in glaciology, so that we hope to have an interesting discussion after the paper.

Professor Ahlmann then read the paper printed above, and a discussion followed.

The PRESIDENT: I will call first upon Dr. Sandford, who was a member of the Oxford Arctic Expedition to North-East Land, 1924.

Dr. K. S. SANDFORD: Professor Ahlmann is one of those who are engaged in making glaciology an exact and precise science, and he is doing it at the right moment, because our ordinary observations are beginning to lead us into some difficulty. There have been many classifications of ice forms, and I think one of the last, that of Wright and Priestley, was highly satisfactory and stood us in good stead for many years, but now we see this very precise work coming along and supplementing the early classifications, which in part at least have served

their purpose. Like many others, I have very much enjoyed listening to Professor Ahlmann's dissertation. I reviewed his first volume of results for the *Journal*, and perhaps it might be of interest to you to know that it took me three months to digest it, which gives some idea of the work comprised in that volume, and now there are other volumes in process of coming out. I congratulate Professor Ahlmann on his journey. The Oxford Expedition of 1924, by bad luck, got into North-East Land a little late in the season and encountered certain difficulties. Professor Ahlmann got in a little earlier, and performed a really amazing journey. I should like to offer my congratulations on that remarkable performance.

As to the question of wind, which is mentioned once or twice in the paper, the blizzards are very severe perhaps in winter, but certainly in summer, and clearly there must be an appreciable loss to the surface by blizzard removal throughout the whole year, but probably in certain months especially so. I am not quite sure how that would be represented in such sections as he was showing us. Some of the snow of course is entirely lost to the whole system. A second point which particularly interested me, especially in relation to North-East Land, was the reference to ice crusts. When we were at the highest part of North-East Land we noticed blue ice, and all three of us who were there formed the impression that it was blue ice to a considerable depth. That is of great importance to the expedition going up to North-East Land this year. If they are superficial blue ice layers they are merely incidental and probably of no great thickness underneath; otherwise it may be impossible to dig it into blocks to obtain shelter.

I should like to ask Professor Ahlmann how he overcomes the direct rays of the sun shining on his ablatograph. We saw a photograph of that instrument which he has himself invented and constructed, and it seems to me that there will be some reciprocal effect from the instrument from such rays. I have no doubt he has some method of allowing for that in making his calculations. It would certainly cause, I should think, an addition of ablation in the immediate vicinity. I congratulate Professor Ahlmann and thank him for the lucid and extremely interesting account to which I have just listened.

The PRESIDENT: I will ask Mr. Gerald Seligman to speak. Mr. Seligman is the author of a paper on "Properties of Ice and Snow" in a Ski Club Year-book.

Mr. GERALD SELIGMAN: I have listened to Professor Ahlmann with the greatest interest. It is no small achievement to deal with so complex a subject in a foreign language. It is like heaping Pelion upon Ossa and climbing them both. We have just heard from Dr. Sandford that it took him three months to digest Professor Ahlmann's earlier work, so that for you, Sir, to call upon me to give an opinion on a lecture of this character at short notice is to expect a great deal of me. I, personally, was immensely interested in it as being of the greatest help in the work that some of us are trying to do in the Alps to elucidate certain of the snow problems we are meeting there.

I have one question to ask. In his paper Professor Ahlmann states that the greatest ablation takes place with a humid wind of high speed. I can very easily understand that wind of high speed containing a great deal of moisture would deposit much of that moisture on the snow, and in doing so would generate heat. That, no doubt, is one of the reasons why it helps the ablation. What I do not quite understand is why the moisture should assist, as it were, the wind in respect to the ablation, because evaporation must be taken into account, and evaporation, although it has been said that it is of not so great importance, is cut out altogether by raising the humidity of the wind. If we take the extreme case of wind containing 100 per cent. moisture we should get no evaporation taking

place under those conditions. I am sure there is some explanation, and I should like to know what it is. A point entirely new to me is that in Antarctic regions we get very little blue ice. If that is the case it is most interesting, and would, no doubt, be accounted for by the great altitudes from which the ice is derived in Antarctic regions, where melting cannot take place.

The PRESIDENT: Dr. Fritz Loewe, one of the party at the Central Ice Station of Wegener's expedition to Greenland, will make a few remarks.

Dr. FRITZ LOEWE: I must, in the first place, apologize for my poor English. Nevertheless I wish to congratulate Professor Ahlmann on his very important new "Contribution to the Physics of Glaciers."

It is astonishing that our knowledge of glacier conditions in the accumulation area is much greater in polar regions than in the Alps, which afford easier facilities for an intensive study of glaciers. For instance, no systematic measurements of the temperature of alpine névés exist, a fundamental necessity if we are to understand the likewise unknown way in which in the highest alpine regions snow is transformed into firn and firn into ice. It is to be hoped that the knowledge gained by Profesor Ahlmann and his companions with regard to polar and Scandinavian glaciers will stimulate the study of the corresponding alpine conditions.

Professor Ahlmann mentioned Alfred Wegener as one of his predecessors. Unfortunately, on Wegener's last expedition two of the three glaciologists were unable to do scientific work. One died, and the other got seriously frostbitten. We made a thorough study of the mass balance and heat balance at the Ice-Cap Station under high polar conditions, the results of which will, I hope, be published soon. There, melting as a factor in transport of mass and energy is entirely absent and conditions are therefore relatively simple. We gained however little knowledge in regard to the condition in the transitional zone where melting takes place in summer, but nevertheless accumulation preponderates over ablation, as it does on the Isachsen Plateau. This gap Professor Ahlmann has filled. I was interested to hear that ablation is higher in periods of warm and humid air than in those when the air is warm and dry. If other conditions are the same, that can hardly be understood. Is it because humid air is connected with greater cloudiness and consequently the outgoing radiation is diminished? Thus the layer of cold air covering the snow surface is easily disturbed, and the heat convection at the surface is consequently greater. That the ice crusts separating the layers of different years are formed in the autumn confirms the somewhat uncertain hypotheses of De Quervain and Wegener and the estimates of annual accumulation on the Greenland Ice-Cap based thereon.

One component of the accumulation of polar ice-caps is hoar-frost with clear sky due to direct sublimation by cooling through outward radiation. It has been suggested that this kind of deposit is the most important component in the accretion of the central inland ice regions. I do not agree with that suggestion, but it would be highly interesting to know whether the measurements in Spitsbergen gave any hint as to the relative importance of this component. It is most interesting to know that on the Spitsbergen Ice-Cap there is a large surplus of ablation over accumulation which corresponds so well to the external appearance and behaviour of the front of many Spitsbergen glaciers. We have not yet a very clear idea of what happens in Greenland; but it seems that there the conditions are inverse to those found in Spitsbergen: that the accumulation, in the mean, exceeds the ablation.

As far as I understand, Professor Ahlmann makes temperature conditions the touchstone in his classification of glaciers, calling "temperate" such glaciers which are at melting-point throughout, and "polar" those which, at least in the

accumulation area, are frozen to a certain depth. In that I agree completely with him. As Professor Ahlmann found, the Isachsen Plateau shows temperate conditions. But the additional qualities given by Ahlmann's definition to the temperate glaciers do not seem to exist there. Their snow and firn should form a rather thin layer, whilst in Sverdrup's opinion the firn reaches down to a considerable depth, which in Professor Ahlmann's classification is a quality of a polar or even high-polar glacier. Also the "slow" recrystallization of firn crystals mentioned by the lecturer means rather " polar glacier" conditions. Thus his last studies seem to show that slight alterations in his "Geophysical Glacier Types" of 1933 would make his classification more valuable still.

In conclusion, I wish once more to emphasize what a lot of valuable new information Professor Ahlmann has laid before us this afternoon.

The PRESIDENT: We should like to hear Mr. Glen, the leader of the forthcoming Oxford Expedition to North-East Land. I may say that the lecturer is the only man who has visited the district where Mr. Glen proposes to make his base camp.

Mr. ALEXANDER GLEN: I may point out that it was largely due to my good fortune in meeting Professor Ahlmann in King's Bay during the summer of 1934 that the first idea of this North-East Land Expedition came into my mind, and I should like to record how very grateful I am to Professor Ahlmann for the help he has given us on every possible occasion. It is our intention to establish two winter stations on either the East or West Ice of North-East Land. The reason for two stations is that part of our programme covers the investigations of wind conditions as well as of general meteorological conditions, an interesting study of which ought to be possible from one inland station on the ice summit (about 2400 feet), another at perhaps 1200 feet or lower, and from observations at the base station in Rijps Bay, at sea-level. In addition we hope to carry on investigations on the precipitation and to continue Professor Ahlmann's work on ablation. This last will be done by one of the above two stations over the whole year, and the change over from winter to summer conditions should prove especially interesting. Professor Ahlmann is coming to Oxford in a day or two to give us his advice on our plans, and we are very grateful to him for the assistance he has given us.

The PRESIDENT: Mr. John Wright, of the Hagavtn Expedition, Iceland, 1934, and a member of Glen's expedition, may like to add something to what has been said.

Mr. JOHN WRIGHT: I do not feel at all qualified to express any opinion of Professor Ahlmann's lecture since I have had practically no experience of glaciological work, but I have two points which I should like to raise in comparing his observations with those that we made in Iceland. We were not making a detailed investigation of glaciology, but chiefly doing survey work, and endeavouring to discover the general physical régime of this lake. In the light of this lecture however I cannot say whether our observations support Professor Ahlmann's theories or not. In one or two cases they certainly do. First of all, he said that radiation was very much greater on snow-free areas of ice, and our observations certainly confirm that, because where the snow had been melted off the ice-cap on the edge of which we were working, the importance of radiation was clearly shown by the usual phenomena of ice-dirt cones, in which the dirt blown on to the glacier protected the glacier from radiation, and so raised a cone which might be anything up to 4 or 5 feet high; also by ice wells in which dust sinks into the ice because of the increased heat due to radiation. We were fortunate enough to be shown photographs of the ice-cap on which we were working taken nine years previously, and these showed that there had been a

retreat of something like a kilometre of the ice. It has been mentioned that in the 1934 Expedition the air temperature was measured and the ordinary meteorological phenomena taken at the snow surface and also at heights up to 5 metres. I believe that some difficulty in measurement was encountered, and I should like to know how they obtained accurate readings.

The PRESIDENT: A Fellow who could not be present this afternoon has sent a request that the lecturer would offer some suggestion as to the cause of that very disturbing and even terrifying noise which he heard occasionally upon the ice-pack in the middle of Greenland.

Professor AHLMANN then made the following reply: As regards Dr. Sandford's question about the effect of strong winds on the glaciers, there is beyond doubt a great drifting of snow especially in winter from one place to another on the North-East Land glacier-caps as well as on the other ice- and firn-plateaus in Spitsbergen. Concerning the Fourteenth of July Glacier, as I have just said, the amount of this transport of loose snow can be calculated at about 9 millions of cubic m. The quantity that the accumulation area thus loses will be represented in the sections of the ablation area. This drifting can be so great that the whole quantity of precipitation in solid form will be swept away from large parts of the accumulation areas. According to M.M. Ermolajeff such conditions prevail on the northern island of Novaya Zemlya. During my sledge journey across the central parts of the North-East Land glacier-caps I did not find any snow-bare ice and the pits showed more than 2 m. stratified firn.

It is quite correct that the radiation from the sun has some effect on the float of the ablatograph. In my description of this instrument, mentioned in my lecture, I have given an account of the corrections necessary for these "independent movements of the float." The examples here given represent exceptionally great values of the independent movements. In general they are much less and on ice they are of very little importance.

I am very glad to have had the opportunity of giving Mr. Glen some advice about his expedition to North-East Land this summer and I am looking forward with great interest to a more detailed discussion with him about the glaciological programme; at the same time I should like to wish the expedition every success.

In answer to Dr. Loewe's question about the hoar-frost, I should like to say that its formation plays an important rôle in the alimentation of glaciers in districts with maritime climates. In Norway I have proved this in the highest part of Jotunheim, and my assistant in 1934, Mr. Olsson, measured very great quantities of hoar-frost on Mount Nordenskiöld in Spitsbergen during the Polar Year 1932–33. Most of the "snow" accumulated on this mountain is not snow fallen but hoar-frost. In districts with continental climates, as for instance Central Greenland, I cannot believe that hoar-frost plays any really great rôle.

Concerning the application of my geophysical classification of glaciers to the Isachsen's Plateau and the Fourteenth of July Glacier, it is obvious that they must be regarded as "temperate." I also refer to my note about this classification, added to my lecture.

Mr. Wright's question about the temperature measurements on Isachsen's Plateau can only be answered by Professor Sverdrup's treatise on his investigations, the methods and instruments employed being of such new and exact types that they require a detailed description.

Concerning the important and complicated problem of the relative importance of melting and evaporation, I shall take the liberty of asking Professor Sverdrup for a short account (see above, p. 107, Additional Notes no. 3).

The PRESIDENT: I am sure you will have appreciated, as I have, the lucid and practised way in which Professor Ahlmann has delivered his paper. Some of the

uninitiated among us, including myself, have no doubt found that in the more technical parts of his address he has been to some extent speaking over our heads, but we can all appreciate the interest and importance of his subject and admire the skill which enabled him to deal with it effectively in a language not his own. As you are all aware, we have constant reason to be grateful to our Scandinavian friends for cooperation in connection with exploration in the north polar regions; and, as you have just heard, Professor Ahlmann has already been giving Mr. Glen the benefit of his cooperation and will continue to give it in connection with the latter's coming expedition to North-East Land.

It has been a great pleasure to us to welcome Professor Ahlmann and his wife, and we hope that during their stay in England it will not be all work and no play for him, but that they will have time to see something of our countryside.

Mr. N. E. ODELL *sends the following contribution to the discussion:* Professor Ahlmann has made a long series of observations upon the glaciers of Scandinavia and of Spitsbergen, and it was a pleasure both to hear the lecture upon his important conclusions and to have the opportunity later to discuss some of those conclusions, as well as the deductions that may be made from them.

His studies with those of Professor Sverdrup, upon ablation processes, and the determination of heat-convection as opposed to radiation, and the evaluation of these relative to melting, are of the greatest importance, not only for their explanation of the way in which glaciers of the regions studied are at present so fast wasting away, but for the emphasis they lay on the value of such observations in countries and districts which derive their water supply in large part from mountain snows and glaciers. Some studies with this end in view have recently been begun on the western slopes of the Cascade Range and the Sierra Nevada of western U.S.A., and from my friend Mr. François Matthes, Chairman of the Committee on Glaciers of the American Geophysical Union, I have lately received a small paper[1] treating of ablation on snowfields. Under the conditions prevailing in those parts, Matthes has shown that so great is the ablation by evaporation from the upper snowfields that the latter must be excluded from any estimates of run-off based upon "snow surveys." On the glaciers of Mount Rainier, for instance, surficial melting in sufficient quantities to produce rills and rivulets on the ice does not extend above an altitude of about 7000 feet. "On warm days," Matthes states, "these streamlets form miniature river-systems, with miniature waterfalls, lakes, and canyons in the ice. They are truly impressive for the volume of water they carry off, but far more impressive, if one stops to consider it, is the fact that from this low level upward to the summit of the peak (14,408 feet), through an altitude range of some 7000 feet, the snow and névé extend with dimpled, sun-cupped, sun-pitted surfaces (due to evaporation) that are perpetually dry." Matthes considers that any quantities of water that may be released by the warmth of the mountain or by pressure melting from the basal layers of these névé-fields are probably so small for all practical purposes as to be negligible. It is therefore from the lower portions of the glaciers, and those alone, that the great floods of melt-water in summer are derived, the function of the névé-fields being the indirect one of supplying water only in the solid state to the glaciers. Observers taking part in the "snow-surveys" in the Sierra Nevada are now engaged in trying to find the level of the zone of maximum snow-precipitation and of melt-water yield.

As to the important rôle played by melting as opposed to evaporation which

[1] François Matthes, "Ablation of Snow-Fields at High Altitudes by Radiant Solar Heat," *Transactions of the American Geophysical Union*, Fifteenth Annual Meeting, 1934.

Professor Ahlmann has shown takes place on the low altitude, "Sub-Polar," glaciers of Spitsbergen and North-East Land, I am able to bear him out if only from qualitative observations made during two sledging journeys (1921 and 1923) in Spitsbergen. Nothing is more striking than the vast amount of melting and the resulting rivers and lakes of melt-water which form during the summer, even under prolonged conditions of saturated atmosphere and thick fogs. With regard to the general recession and shrinkage of glaciers and snow-fields, to which Professor Ahlmann makes reference, I can fully support him with quantitative field evidence from southern New Friesland and Garwoodland. In the latter region of eastern Spitsbergen certain higher peaks now project above the highland ice-covering some 1000 to 1500 feet. On many of them, owing either to similar adjacent formation, intensive frost-splitting, or other causes, there is no definite evidence from erratic perched blocks of an earlier and higher level occupied by the ice. But in one instance at least, on the great mountain-nunatak, at the head of the Nordenskiöld Glacier, Mount Ferrier, there was unequivocal evidence—and a minimum measure of the amount—of the former much higher stand of ice in these parts. On the eastern ridge of that limestone mountain were found granite blocks at 1000 feet above the general level of the highland ice-sheet lying eastward of it, their composition arguing their derivation from the Chydenius Mountains to the north-east, and their elevated position proves that the ice in this region was formerly far more inundated. Only future exploration and observation can determine what the maximum "glacierization" of Spitsbergen amounted to and whether it ever entirely enveloped all the highest peaks or not, apart from the question as to when it last occurred, and if its incidence has been cyclical and entirely due to the variable heat capacity of the North Atlantic Drift, as Professor Ahlmann supposes.

Although Professor Ahlmann puts forward his geophysical classification of glaciers purely as a preliminary one, I think it is definitely to be welcomed, since its basis emphasizes a side of glaciological study that has been singularly neglected. Morphological studies of glaciers, which have been pursued for so many years, have really done little to advance our knowledge of the real constitution of glaciers, their mode of motion, and the question of their potency as erosive or merely abrading agents. The intensive physical examination of the kind that Professor Ahlmann and his collaborators are carrying out seems therefore to afford new hope for the immediate future of glaciology as a whole. What is clearly wanted now is a series of similar observations upon the glaciers of other regions, and particularly at the highest altitudes, where a peculiar combination of arctic and tropical external conditions are to be found. If systematic and detailed observations of the kind that Professor Ahlmann has made with such admirable enterprise in high latitudes, could be extended by some of the projected expeditions in the near future to the high altitudes of the Himalaya, and especially perhaps the coming Mount Everest Expedition, we should be going some way in our support of the suggestion of cooperation made by him to the Society.

Professor AHLMANN: After reading Mr. Odell's contribution to the discussion I am very glad to acknowledge the importance of his observations in Spitsbergen. I should also like to call special attention to the advisability of physico-glaciological investigations on glaciers at the highest altitudes. In my opinion these observations are now the most important contributions to glaciology. Special methods can be worked out and instruments constructed for climbing parties on the highest parts of the Himalayas or Karakoram. I should feel more than pleased if my lecture could bring this about.

THE LAKE RUDOLF RIFT VALLEY EXPEDITION, 1934:

A paper read at the Evening Meeting of the Society on 15 April 1935, by

V. E. FUCHS

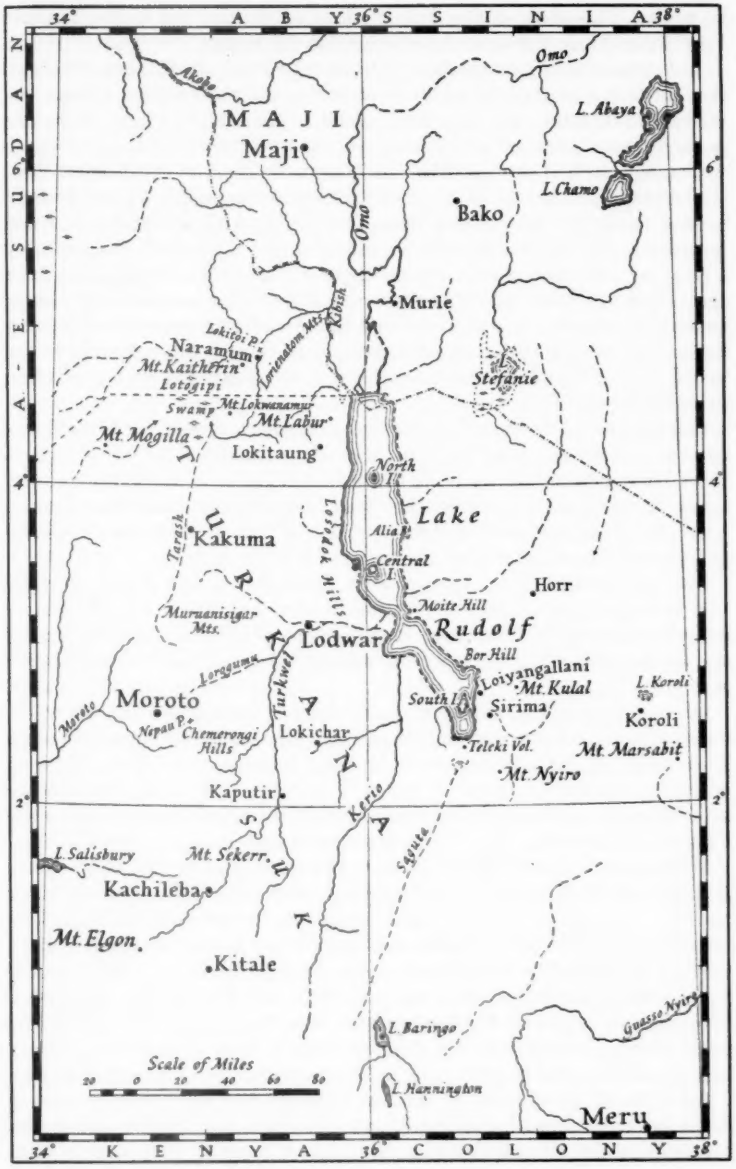
THE Lake Rudolf Rift Valley Expedition was projected with the main objects of geological and survey work in the northern part of the Rift Valley in Kenya Colony. Since this area is still so little known it was decided to attempt as many other lines of investigation as possible. Accordingly the party finally numbered six, of whom two, Mr. R. C. Wakefield, of the Sudan Survey Department, and Mr. W. R. H. Martin, were surveyors. Mr. Martin also undertook to collect botanical material since he was a qualified forester. Dr. W. S. Dyson was to act as the expedition's medical officer and to be in charge of the zoological collections, besides carrying out such anthropological work as was possible. Mr. J. Millard undertook the collection of archaeological material, while Mr. D. G. MacInnes, who was already in Kenya studying Miocene deposits on Lake Victoria, joined the expedition as palaeontologist. Mr. V. E. Fuchs was geologist and leader of the party. Mr. David Buxton, of the Agricultural Laboratories, Kampala, also joined the expedition during those months spent in Turkana. He was particularly concerned with the locust problem but also contributed largely to the expedition's zoological collections.

It was entirely due to the generosity of the Royal Society, the Royal Geographical Society, the Geological Society, the British Association, and the Percy Sladen Trustees that the expedition was able to attempt such an ambitious programme or indeed set out at all. The Royal Geographical Society also lent all the scientific instruments used during the expedition.

The expedition would like to thank the officers of the Kenya Administration in Turkana Province, particularly Mr. A. M. Champion, Provincial Commissioner, and Mr. Morgan, District Commissioner, who were extremely helpful at all times. Our thanks are also due to the officers of the King's African Rifles, who greatly assisted in transport and other matters, and to the Administration of the Kenya and Uganda Railways and Harbours who lent us a boat for the search operations which were unhappily needed.

The original plan for the expedition was that it should make a continuous journey round the lake, starting from Lodwar, the administrative post, some 40 miles from the western shore. Owing to the refusal of the Ethiopian Government to grant permission for the expedition to enter Abyssinian territory, this plan had to be modified so as to omit the extreme north end of the lake, which lies just over the border. It was therefore decided to conduct the work in two sections, first on the west of the lake and then on the east.

Lake Rudolf lies in the northern end of the rift valley in Kenya and is approximately 1230 feet above sea-level. It is about 180 miles long and has a maximum width of 35 miles. The whole of the area with which the expedition had to deal lies between latitudes 3° and 5° N., and longitudes 35° and 37° E. The greater part of the country surrounding the lake is of desert character, the only permanent river flowing into the lake being the Omo, that rises in the Abyssinian highlands and reaches Rudolf at its northern end. There is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Mt. Lokwanamur
Mt. Labur
Mt. Mogilla
Lokitaung
Loriandom Mts.
Kibish
Stefanie
North
Lake
Rudolf
Alia I.
Central I.
Kakuma
Turash
Lorora Hills
Horr
Moite Hill
Muruanisigar Mts.
Lodwar
Bor Hill
Loiyangallani
Mt. Kulal
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Koroli
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South I.
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Nopau P.
Chemerongi Hills
Teleki Vol.
Mt. Marsabit
Mt. Nyiro
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no outlet. The whole of the western shore of the lake lies in the Turkana Province and here the work of the expedition was begun.

In February 1934 the expedition arrived at Lodwar. At this time it was still thought that it might be possible to enter Abyssinia if personal contact was established with the local Ras, or Governor, of the Maji Province. As he had not arrived at the frontier and it was uncertain when he would do so, we began work amongst the Losodok Hills that lie between the lake and Lodwar Post. We had expected that the Miocene rocks of which these hills are formed would yield a fairly rich mammalian fauna, for in 1932 M. C. Arambourg had recorded a few fragmentary fossils and stated that the deposit was probably a rich one.[1] In this we were disappointed, for in spite of finding the exact spots from which he had obtained his specimens, we recovered a very small amount of material. It was found that the fossiliferous band was comparatively thin and that the specimens occurring in other beds of the series were so much altered by earth-movement or volcanic water that they were of no palaeontological value.

Our visit to the district was however by no means useless, for Millard discovered numerous "coup de poings" of late Acheulean age: the first pre-Neolithic implements to be found in the Rudolf basin. At this place the tools occurred on the surface, and it seemed that they were *in situ* on that surface, which had been neither eroded nor covered by later deposits since the early pleistocene lake retreated from the area.

Here too the first signs of compressive forces in this part of the rift valley were seen, for the Losodok Hills themselves were found to be a series of overfolded lavas and tuffs. Since the rocks are of Lower Miocene age we now know that compressive rifting forces were at work by the time of the Middle Miocene at the latest.

One day we made a trip to the lake shore at Ferguson Gulf where the Cambridge Expedition had had its camp in 1930. My old friends, the two Turkana chiefs, welcomed us with apparent jubilation, and there and then ordered a dance which lasted for two or three hours in the heat of the midday sun. We suspected that all this joy at our arrival was more in homage to our tobacco than to us, for every Turkana is an inveterate tobacco chewer.

What astonished us most was the change in the shore-line of the lake. Since January 1931, that is almost exactly three years before, the level of the water had fallen approximately 4 feet, which meant that on this gently shelving shore the edge of the lake had retreated over a quarter of a mile. On the mud flats, exposed by this retreat, the Turkana were growing considerable areas of millet.

We were considering moving our camp to the lake shore at this point, when news came through that the Ras had arrived at the frontier. We accordingly made all speed to get there, and after one night at Lodwar made the journey by car and lorry to Lokitaung, the chief military post in Northern Turkana. Thence we travelled down to the lake, through the impressive Lokitaung gorge that is cut through a series of tilted grits overlain by a great thickness of basalts. The gorge opens suddenly on to the plain left by the retreat of Lake Rudolf, and 20 miles farther to the north we came to Todenyang, the British Fort on the shore of the lake. Three miles away lies the Abyssinian Post of

[1] M. C. Arambourg, 'Comptes Rendus Acad. des Sciences,' fév. 1934, p. 671.

Namoraputh. A few years ago both the places would have been described as on the southern sand spit which divided Sanderson Gulf from the main lake. At the present time there is no gulf, and the lake continues its steady retreat. Later on we found that approximately 2 miles from the shore the water is only about 8 feet deep. Should the lake-level continue to fall at the average speed maintained during the last thirty years, it will be little more than ten years before the northern shore of the lake has retreated some 10 miles to the south of the now accepted boundary between Abyssinia and Kenya. In March 1934 a steel post was cemented into the rocks on the edge of the lake and a mark cut 2 ft. 9 ins. above the level of the lake. The shrinkage of the lake may almost be accounted a danger to the surrounding country, for the prevailing south-east wind dries the bare sand of the shore and blows it inland in the form of dunes, which have their origin only 100 yards from the edge of the lake and are now sweeping forward at a rate of something like 50 yards a year.

At the time of our arrival at Todenyang, the Ethiopian and Kenya authorities had arranged that there should be a peace meeting between the native tribes on either side of the boundary, and we were fortunate to be present at this interesting scene. The two tribes concerned were the Merille (probably the Merle of von Höhnel and others) and the Turkana. The ratification of the peace necessitated killing a white sheep and a white bull, both supplied by the elders of the aggressor tribe. It was interesting to note that though the chief of the Turkana was present, he took no part in the actual ceremony as he was still a warrior and therefore led them in battle only. The elders of either tribe squatted in a row, all the Turkana being, in this case, on the left and the Merille on the right. The white sheep was then killed in front of the assembled elders. Strings of fat were taken from the entrails and draped round the necks of the Turkana by the elders of the Merille. The white bull was then slaughtered, a bone from a front leg broken with a stone, and the marrow sucked from a half by the chief elder of each of the two tribes. This completed the ceremony and all concerned sat down to feast on the carcasses of the two beasts.

On this occasion of the peace ceremony we asked permission from the Ras to enter his territory, and much to our surprise he assented readily enough, saying that he would send the necessary letter of safe-conduct into camp the next day. In the end we were disappointed, for the letter never appeared and the Ras himself returned to Maji the same day.

Even in British territory we were compelled to have a military escort with us, so that at our next camp we numbered thirty. This included the six Europeans of the expedition, a section of native troops, native police, camel and donkey boys, and our own cooks and servants. At this time our water supply had been reduced to 40 gallons per day for the whole party, to include cooking, washing, and drinking. There had to be supervision of the natives, but we found that this amount of $1\frac{1}{3}$ gallons per day per person was quite reasonable. Nevertheless it was our aim throughout the expedition to maintain a supply of 2 gallons per day per person, for this was found to be the minimum amount which prevented quarrelling amongst the native staff.

The shortage of water in this district was more serious for the native population, and several times Akal, chief elder of the northern Turkana, asked us to

bring them rain. He told us that the failure of the rains during the previous two years had caused numbers of their cattle to die, so that the poorer people were in an extremely bad way. He said that he knew we could bring rain if we wished, and asked that we should at least mention the matter to the Government. This we promised to do, hoping that he would cease demanding miracles, but next day he was back again with the same preamble and the same request, till it became evident that nothing would convince him of our impotence in the matter. In desperation and on the strength of the gathering clouds over the Abyssinian highlands, we told him that rain would fall within a fortnight. Two days later we left Komogin, and afterwards we heard that he was not disappointed, as on the fourteenth day 6 inches of rain fell in four hours: a great piece of fortune for our good name.

From Komogin we had hoped to climb Mount Labur (North Peak) as this formed one of the base points used by Gemmel in his topographical survey in 1919. Mr. Champion, who was Provincial Commissioner of Turkana during our visit, has made a very excellent map of the area. In the course of his work he found that there were discrepancies between the surveys of Kenya, Uganda, the Sudan, and other independent work, and to straighten this out we wished to fix Labur and other peaks by astronomical observations, using wireless time-signals for the first time in this area. After several attempts to find a route for the donkeys up the precipitous eastern slopes of Labur, it was decided that it would be more suitable to approach the mountain from the west. Accordingly we returned to Lokitaung, whence the donkeys were sent on with the instruments and supplies, while the surveyors followed the next day to spend three nights on the top of the mountain. Labur might be called the surveyor's ideal mountain, for its peculiar form is easily recognizable from a distance and the cone-like summit projects from the seemingly flat top as if built for the purpose. The observations that were then made on the mountain have shown that its accepted position was some 40 seconds too far East in longitude, and there was an error of about 33 minutes in azimuth.

After the work on Labur the expedition left Lokitaung for Naramum, some 70 miles farther north. Naramum is in that part of the Sudan territory which is controlled by the Kenya military authorities. The place itself is no more than a water-hole among the foothills on the western side of the wide level-floored valley between the Kaitherin–Lokwanamur range and the mountain mass called Lorienatom. We found that this valley had once been occupied by a shallow lake, which most probably connected with the north end of Lake Rudolf *via* the Lotogipi swamp. From the northern end of this valley there is a sheer drop to a plain below that stretches into the far north-west, and over this plain the outlet from Rudolf used to flow in the past, thereby forming a link with the Nile system.

From Naramum we climbed Kaitherin Peak, on the top of which the surveyors again spent four or five nights. Though they were able to make observations, they were greatly hindered by the rains which were now beginning, and visibility became so bad that it was impossible to take reliable rays and vertical angles to the mountains in the west. There thus remains this one link to be made before the height of Lake Rudolf can be referred to the

The expedition's first camp

A typical scene at a Turkana water-hole

Lodwar Hill from the south. (*Infra-red photograph*)

trigonometrical heights of the Sudan. When this can be done the lake will form a useful datum for a very wide area.

On our return from Naramum to Lokitaung we first saw the effect of the recent rains. Nearly all the dry river-beds had been washed out to a greater or lesser extent, and we had to stop continually to rebuild the track across them. In the few days that had elapsed since the rain began large areas of previously barren country had assumed a green flush, as all the waiting seeds took their opportunity, and the apparently dead thorn-scrub began to clothe itself. We saw now for the first time large numbers of Grant's gazelle that had come from more barren districts to feed upon the fresh growth.

From Lokitaung we continued our journey to Lodwar. On the way the sandy and bouldery track was relieved by the new growth, of which the most striking were numbers of red and yellow lilies that had burst into flower. They seemed out of place indeed in this normally bare expanse.

At Lodwar the expedition was joined by Dyson, who had just arrived from England. Millard and I then left on a rapid reconnaissance journey to Kaputir, about 80 miles farther south, while the rest of the party occupied themselves with their own particular work around the base camp. The country between Kaputir and Lodwar appears to be a peneplain surface, once probably continuous with the top of the Sekerr–Chemerongi escarpment to the west, its present position being due to the Rift Valley fractures which have lowered this area relative to the rest of the country. From Kaputir we returned along the foot of the escarpment to the corner of the Moroto embayment, where we once more joined the Kitale–Lodwar track. During the whole journey we passed through barren, sandy, or rocky country, the rocks belonging entirely to the Basement Complex series. The only vegetation occurred sparsely along the dry river courses, in particular on the banks of the Turkwel river.

After the Kaputir journey the whole expedition moved down to the lake shore at Ferguson Gulf, where Wakefield and Martin set about re-mapping the gulf for comparison with Dr. Worthington's (1931) and earlier maps. At this time the difficulty of obtaining drinking water was overcome by the use of a wood-burning still that weighed approximately 100 lb. in all. The output in the sun, when the shade temperature rose to 110°, was 1 gallon per hour. While at the lake two journeys were made to Central Island, a distance of about 9 miles by water from the Ferguson Gulf camp. The expedition's boat was a Hudson collapsible wooden boat fitted with an outboard motor. For its size this is an exceedingly stable craft, and has been approved by the Air Ministry for use in connection with flying boats. These boats were also used by the British Arctic Air Route Expedition. By the kindness of the Provincial Commissioner my wife was able to visit the expedition's camp on the lake for a few days, and she accompanied me on the first trip of the year to Central Island. We found everything much the same as it was in 1930 when Dr. Worthington made the first crossing to it, but the low-lying parts of the shore had changed their outline slightly owing to the fall in the lake-level. We returned the same evening, arriving in camp about 10 p.m. The second visit to the island was made by Dyson and Millard, who stayed there eight days in order to make complete botanical and zoological collections, with the object

of finding to what extent the lake acts as a natural barrier to the migration of the fauna and flora of the adjacent areas.

On our return to Lodwar from the lake we had planned that the surveyors should travel to Mogilla mountain in the far north-west of the province, while two others should visit the Dome Rock area just south of Muruanisigar, which forms the northern edge of the Moroto embayment in the Uganda scarp. On April 26 the surveyors left Lodwar and succeeded in reaching Kakuma by car just before the rains began in earnest; from Kakuma it was necessary to continue with camel transport. All was ready for their departure the next day, but that evening it poured steadily and the normally dry Tarash river came down in flood and swept over the plains to the north, turning them into a sea of mud impassable for camels. In fact it was only with a great deal of difficulty that they managed to bring the camels to their own side of the flooded river. After some days it became apparent that conditions would not improve sufficiently for the journey to Mogilla to be accomplished in the available time. An attempt was therefore made to climb Peleketch peak, but again the heavy rain frustrated the attempt.

Meanwhile MacInnes and I had left Lodwar for Dome Rock. We had travelled some 30 miles when we were held up by the flooded Lorogumu river. As we reached its bank a storm heralded by an ominous yellow cloud of dust swept up from the south, and a quarter of an hour later the surrounding country had changed from a flat expanse of sand into the semblance of a lake, from which stood out a few drowned bushes. We attempted to return to Lodwar, but found ourselves cut off by a second river that had come down in flood behind us, and only next morning had the water subsided enough for us to resume our return to Lodwar. About this time we heard that the heavy rains had washed away part of the motor track down the Suk escarpment, which meant that we were virtually prisoners in Turkana until such time as the road should be rebuilt. Nevertheless the enforced lengthening of our stay enabled us to do additional work, in particular the collection of zoological and botanical material, as the coming of the rains had brought out large numbers of new specimens.

At this time the expedition camp was pitched under some acacia trees beside the Turkwel river. The river was about 10 feet deep and its level had been steady for some days; then suddenly one night it overflowed its banks and threatened the camp. Those present at the time hastened to move all the cars and belongings to the top of a nearby hillock, but it was not till the help of some fifty natives had been obtained that it was possible to salvage the lorry which was already in water too deep for us to drive it out. The top of the hillock, only 12 feet above water, proved very cramped quarters for five tents, a lorry, two cars, the kitchen, and some ten natives. Lodwar Boma itself had also become an island, and Mr. Morgan, the District Commissioner, rowed over the intervening quarter of a mile of water to have tea with us one afternoon.

A week later the expedition left Lodwar on the return journey to Kitale. After the copious rain the first stretch across the Turkana plains to the foot of the Nepau Pass was positively green compared to the red-yellow expanse of sand usually to be seen. In spite of this pleasing appearance any expectations of good grazing in future months for the Turkana herds were soon set aside,

for this green growth was of weeds and ephemeral plants of all kinds, with hardly a blade of grass. At the top of the Nepau Pass and as far as the foot of the Suk Escarpment a much greater change was seen. In eleven days since the last rain had fallen everything had had time to grow and become green to an extent that would have been unbelievable three months earlier. The road, instead of a dusty red track stretching into the distance through a sea of lifeless thorn-scrub, was now a grassy path shut in on either side by an impenetrable wall of tall green grass beneath the acacias, and the heavy scent of many flowers was in the air.

At Naivasha, in the Kenya highlands, the expedition refitted, and while this was going on arrangements were made with the military and administrative authorities for the second part of the programme to be carried out in the Northern Frontier District. For this part of the work the expedition was to number only four, as Wakefield had to return to his duties with the Sudan Survey Department, leaving Martin to continue the survey. It was also decided that the disappointing palaeontological results obtained on the west side of the lake did not justify MacInnes in accompanying us during the second half of the expedition, as the rocks were almost certain to be of the same series. He therefore returned to his work on the Lake Victoria deposits. The four members of the expedition to work on the east side of the lake were therefore Dyson, Martin, Millard, and myself.

On the way to the Northern Frontier District from the south the last of the settled area is left behind at Meru, on the lower slopes of Mount Kenya. From Meru it is approximately 180 miles to Marsabit, the way leading first across the Guasso Nyiro river, and then over a great plain covered with the ubiquitous thorn-scrub. There live a large variety of game, including the spectacular reticulated giraffe, and that queer giraffe-necked antelope the gerenuk.

Marsabit Boma lies at an altitude of 4500 feet on the northern slopes of Marsabit mountain, a volcanic mass that rises to over 4000 feet above the surrounding plain. The mountain is capped with forest and has a comparatively cool climate and a fair rainfall, although it is in the midst of a desert country. Like the two neighbouring mountains, Kulal and Nyiro, 100 miles distant, Marsabit affords to the botanist and the zoologist not only the possibility of seeing a relict fauna and flora, preserved since the last wet period of the pleistocene, but also of studying them under zonal conditions that vary from complete desert to forest in a distance of 10 miles.

Several days were spent collecting on the mountain while we awaited the arrival of Mr. V. G. Glenday, the Provincial Commissioner, with whom we were to discuss our plans. As he was delayed, Martin and Dyson went on ahead across the southern part of the Koroli desert to the foot of Kulal, where it had been arranged that camels should meet them. Kulal is approximately 7500 feet high, and is a landmark over the whole of the surrounding country. This was to be the first of a series of astronomical points we had arranged to fix on this side of the lake.

A day later Millard and myself left Marsabit on the same road but continued to Sirima water-hole about 8 miles from Rudolf, and 100 miles from Marsabit. This was to become our main base for stores during the next month. Two days later we left Sirima in an attempt to reach the lake with our baggage

camels. In this we were ultimately successful, but only with a great deal of trouble, owing to the rocky and broken nature of the country. Only one camel refused to go, and that not because of the rocks, but because it imagined it would sink into some rather soft-looking damp sand. As there was no way round this patch the camel had to be left behind, and we never saw it again. This route is not advisable for travellers owing to the two very steep scarps down which it is only just possible to take the camels one by one. Nevertheless on the way to the south end of the lake it is the most direct route and may save as much as 40 miles.

At the foot of the first scarp we were still 300 feet above the lake on a flat that had evidently been a lake beach at some time in the past. That our camel men noticed these signs for themselves was shown by them saying that the spot was an unsuitable one for a camp, as it was likely to rain and then the great river would rise and sweep it away. They had never seen a lake before, and thought that this great ribbon of water stretching out of sight in either direction was a monstrous river.

The following day we carried the expedition's boat down to the shore 2 miles away; all the way from Sirima it had been carried by relays of four men, each relay taking its turn for a few hundred yards at a time. Once on the lake, Millard undertook to sail the boat to Loiyangallani, where we had arranged to meet the Kulal party. The rocky and bouldery march along the coast, with its frequent detours, was an arduous journey for the camels. It would be advisable for any one not under the necessity of keeping in touch with a boat on the lake, to follow the inland track generally used by the Rendile.

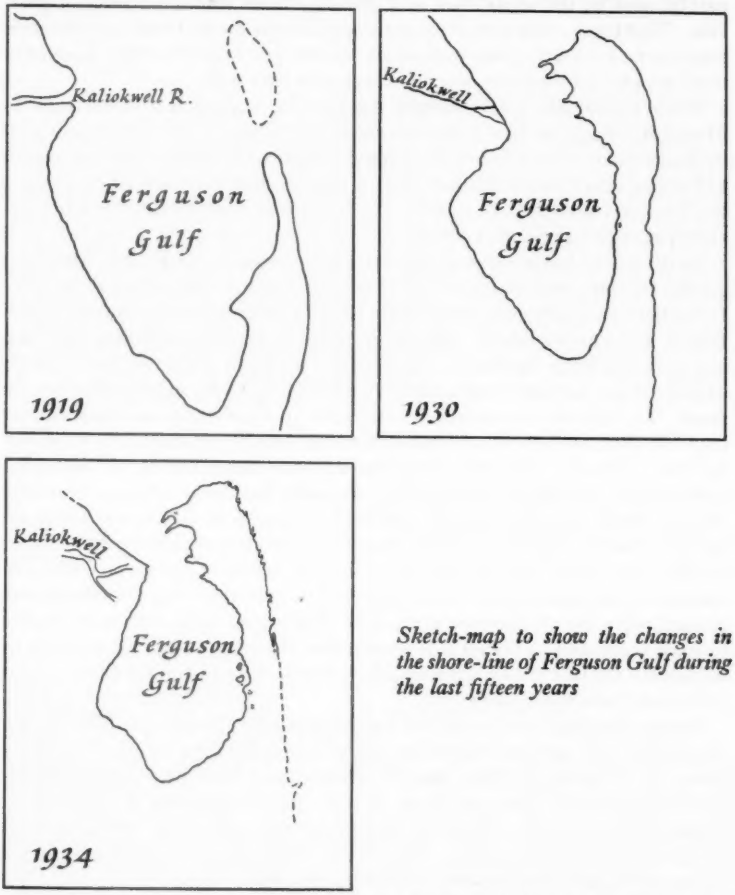
Here at the southern end of the lake the water was, surprisingly enough, far more drinkable than on the north-west shore, or at Todenyang near the mouth of the Omo river. Apparently this is due in some way to the greater depth of the water there, for we found that it was always better to obtain drinking water from as far out in the lake as possible, as the nearer the shore the greater the salt content and the worse the taste.

We were two or three days late arriving at Loiyangallani and found Martin and Dyson starting out to meet us. They themselves had got there only the night before, as they, too, had had great trouble with the camels on the steep slopes of the mountain. At Loiyangallani there is a spring of fresh water that gives rise to a marsh in which we found, much to our surprise, a large number of bulrushes growing.

While we were pitching camp some Elmolo appeared and sold us for a necklace some of their morning's catch of fish. The Elmolo are a dwindling tribe who now number only eighty-four, though in von Höhnel's time they were counted in their hundreds. They then appear to have been the poorer members of three tribes—Reshiat, Samburu, and Rendile—who had come to the lake to live on the fish they could catch. The name Elmolo means poor or destitute ones, and the poor of these three tribes were collectively grouped under this name. To-day the only surviving Elmolo seem to have been descended from the Samburu, whose language they say is similar to their own. Nevertheless they call themselves Elmolo and will not admit that they are descended from any other tribe. When first discovered in 1887 the Elmolo used to live on a number of islands in the lake, but now all save one of these has become connected to the mainland by the retreat of the lake. At present

there are two villages, on on the remaining island, the other on a sand-spit, but close to a rocky islet on which they can take refuge from raiders in case of need.

These people suffer from an almost universal deformity, a forward and sometimes outward bowing of the shin bones, which may reach such a degree that it makes walking a difficulty and gives the leg the appearance of having a second knee somewhere above the ankle. It seems almost certain that the



Sketch-map to show the changes in the shore-line of Ferguson Gulf during the last fifteen years

deformity is due to a diet deficiency. They live entirely on fish, crocodiles, and turtles that are caught in the lake, and the only water they drink is that of the lake. It is known that there is little or no calcium in the lake water, as it is precipitated by the soda-rich waters.[1] It therefore seems possible that not only the water but the animals living in it may suffer from a calcium deficiency, and in this case humans dependent upon the lake for their food and water would probably lack a sufficient supply of calcium.

[1] L. C. Beadle, *Linn. Soc. Jour.—Zoo.*, vol. xxxviii (No. 258), 1932, p. 186.

While we were with the Elmolo, Dyson took anthropological measurements of every adult member of the tribe and general notes as to their condition of health, which in fact was bad, since there was a tendency to scurvy, pyorrhoea, decay of teeth, and arthritis. A peculiarity of the tribe seems to be that the little toe is set far back on the foot; this occurs in about 80 per cent. These people know only two cures for ailments, either blood-letting, or burning the painful spot by the application of a glowing ember through a piece of goat-skin. That these cures were frequently applied was shown by the innumerable scars borne by nearly every individual. It is hoped to give a fuller account of these people and their customs elsewhere, at a later date.

While Dyson and I were visiting the Elmolo, Millard was called back to Marsabit, whence he had to leave immediately to take up a Government post in Basutoland. Our number was thereby reduced to three. On our return to Loiyangallani we found that Martin had finished the work of connecting the lake-level with the known height of Kulal, so we were ready for our long-anticipated visit to South Island.

South Island has an area of approximately 30 square miles and lies about 4 miles from the eastern shore and 15 miles from the southern end of the lake. It has been variously called von Höhnel Island (after its co-discoverer), South Island, and Elmolo Island. The latter name is certainly inappropriate and has probably been applied to it through confusion with the true Elmolo islands which are little more than sand-banks or rocky masses close to the shore. The Elmolo themselves are emphatic in their statement that neither they nor their ancestors have ever visited the island, and they have no desire to do so. There is a legend among the Turkana that a number of fires used to be seen on the island and that they gradually died away till none were left. As this island is purely volcanic and has been active in very recent times we thought that this legend probably arose from the glow of active vents. Then, in 1897, Cavendish was told that at one time the island was connected with the mainland, and some people who happened to have the village on the higher ground, were cut off by a rise of the lake. Having no boats they were unable to leave the island. Though it is known that there have been fluctuations in the level of the lake it does not seem likely that such a sudden rise in the water-level could have taken place.

During the three weeks that we had been working beside the lake we had found that the weather conditions were extremely constant in their daily cycle. In the morning there was usually a strong wind with accompanying rough water on the lake until about 11 a.m., from which time it would begin to die down gradually. By one or two in the afternoon a flat calm prevailed which lasted till about 4 p.m. The wind would then gradually rise again till it blew strongly in the evening and during the night.

Before attempting to cross to the island we moved the camp to a point some 5 miles south of Loiyangallani, as a start from that point would allow a certain northward drift which was to be expected when making the crossing owing to the prevailing wind from the south-east. On July 25 Martin and I made the first crossing to the island, under rather rough conditions, in one and three-quarter hours. At first we found it difficult to decide on a suitable place to

[1] von Höhnel, 'Discovery by Count Teleki of Lakes Rudolf and Stefanie,' vol. ii, p. 101.

The encroaching sand dunes at Todenyang

A Turkana dance *W. R. H. M.*

Typical rainstorm in the Kakuma District *W. R. H. M.*

Crossing the Tarash river after the storm *W. R. H. M.*

make a landing, but finally ran into a sheltered cove between the main island and a smaller one that lies to the east of it. There we made our camp under the shelter of some sloping rocks. Behind the cove the island rose ruggedly upward, appearing almost unclimbable because of the overlapping flows of fresh lava that had run down to the water's edge.

During the afternoon of the first day we investigated the low-lying island that sheltered our bay to the east. It is probable that at the time of the discovery of the lake this island was under water, for during the last forty-five years the lake has sunk at least 30 to 40 feet.

The next day we set off on an exploratory walk over the island. The highest point was our obvious aim, and accordingly we started the arduous clamber up the treacherous slopes. Eight hundred feet above the lake volcanic ashes take the place of the lavas and the going becomes easier. After a little while we saw the tracks of some four-footed animal: a surprise indeed, for we had supposed the island to be uninhabited except by birds. Presently we came upon a pile of bones that appeared to have been those of a goat; but it was not till we reached the highest point, 1500 feet above the lake, that we saw what had made the tracks. There below us was a herd of thirteen domestic goats grazing on some scanty tufts of grass. When we attempted to approach them they were as wild as the wildest antelope; it was evident that they had never seen a man before. Later we found thirteen goat skeletons in various parts of the island, and also a fragment of broken pot and some human bone. This showed us that at least one man had reached and lived upon the island. These finds would seem to support one or other of the stories already remarked upon, but to us it seemed more likely that some unfortunates were driven from the shore by the wind, or by raiders, while conveying some of their flock upon rafts, and had then drifted on to South Island.

The island has a central ridge running north and south which is composed of a series of ash cones; on a number of these we erected cairns for the survey that Martin was to begin the next day. On the east flank of the central ridge a series of lava flows have clothed the whole side of the island till it is almost impassable, but on the other hand the western slopes are of soft ashes over which it is comparatively easy to make one's way. In the northern part of the island the final phase of activity took the form of small streams of black lava that have flowed down over the ashes following the contour of the ground like black glaciers.

The third day was spent in measuring a base and beginning the plane-table survey on the small island to the east, as this was the only available level area. On July 28, the day fixed for my return to the mainland, we continued the survey in the morning, then about midday I left Martin to continue the work alone, while I coasted along the shore to a bay at the northern end of the island, before crossing to the mainland camp. Landing in this bay I found it possible to climb some exceedingly steep slopes of consolidated ash, and to build cairns for Martin's use at two points on the northern end of the island.

The return journey to the mainland took only one and a quarter hours owing to the dead calm prevailing at the time. The next day Dyson left for the island with a boat-load of supplies, and I for the south end of the lake to visit the Teleki Volcano district.

We now approach the time of the tragedy which put a premature end to the Lake Rudolf Rift Valley Expedition. In making our plans we had arranged that if Dyson and Martin were in need of any assistance they should light three fires, the reason for three being that at any time it might become necessary for the two to separate and to camp at different points. This might have meant either one or two fires being seen from the mainland without having any other significance than the cooking of the evening meal. We had also arranged to signal in Morse if necessity arose. There was no question of a signal fire being lighted on the island each evening, as the fact that the greater part of the work would have to be done on the far side of its high hills precluded any possibility of this. If the three fires were seen a message was to be brought to me by some of the men stationed at the lake camp.

We had arranged that the earliest day on which they could be expected to return would be August 5, but that they must be back on August 13. On the evening of August 4 I reached Sirima, our base camp, from the south end of the lake. On August 9 I went down to the lake shore camp to attempt to get into touch with Dyson and Martin. On that evening and also on those of the 10th and 11th of August I could get no reply from the island. It therefore seemed that they were on the west side of the island and were unable to see the signals.

At this stage it became necessary to consider what measures to take should they become overdue, which they would be if they did not reach the shore camp on the 14th, or the base camp on August 15. Therefore if I arrived at Marsabit on the 16th it would be the first day on which one could call for assistance on account of their being overdue. In order to have everything in readiness I left the shore camp on the 12th, arriving at Marsabit on the 13th, whence I sent telegrams inquiring about the possibility of obtaining an aeroplane. Replies were received from Nairobi the following evening. On the 15th I returned from Marsabit accompanied by a police patrol ready to search the shore of the lake. They had not returned, so I immediately started back for Marsabit, where a telegram was sent asking for a Wilson Airway's machine to pick me up at Marsabit and proceed to the island, where at this time I had no doubt we should find them. Owing to a delay to the telegram, the machine did not arrive in time for us to leave for the island that day. It was therefore on the morning of the 18th that Mr. Pearson, pilot, Mr. Clelland, superintendent of police, and I, left Marsabit to search the island and the shores of the lake. We first flew over the base camp to make sure that the missing had not returned the previous day, then straight across to the island, where, flying low it was possible to see the exact spot where the first camp had been; but there was nothing to be seen. We then visited the other suggested camping places with the same result. Later we examined the five small islands adjacent to South Island and the shores of the lake, from Bor on the east and from the Kerio on the west to the south end of the lake, but nothing was seen.

On our return to Marsabit we found that a wireless message had been received stating that a helmet had been found on the west shore of the lake in the Ferguson Gulf region, 70 miles to the north. A message was immediately despatched asking for an aeroplane to be sent to search that area including Central Island.

From August 19 to 22 MacInnes and Millard, who had arrived at Marsabit

W. R. H. M.

Looking south from Labur: lake beds banked against the fault-scarp of gneisses overlain by basalts

W. R. H. M.

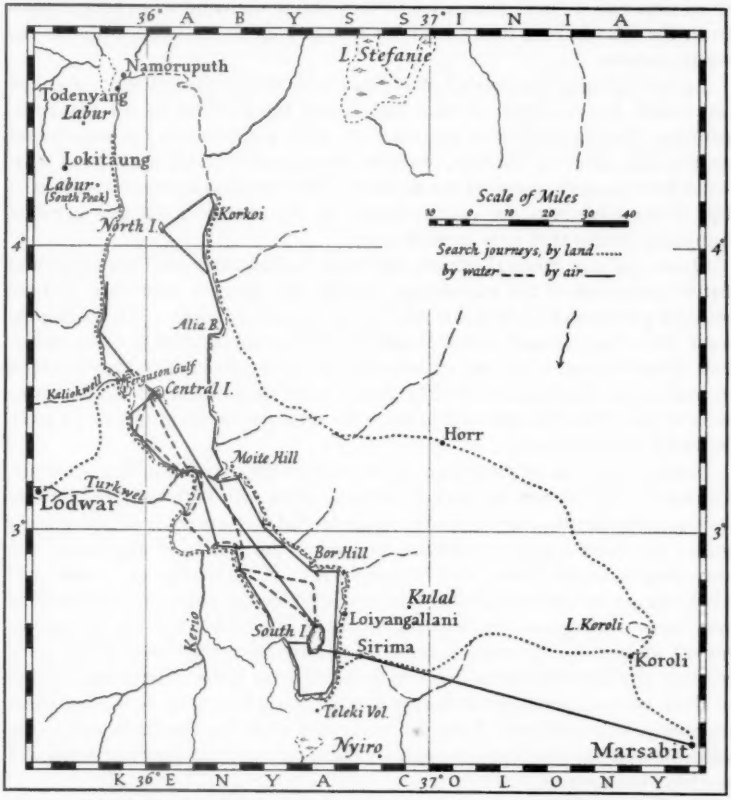
Dome Rock, a plug of pure Orthoclase exposed by denudation of the lavas

Sirima Gorge: a series of Pleistocene basalts

J. F. M.

Bad country for the camels (S.E. of Lake Rudolf)

in the search aeroplane, helped to break the camps at Sirima and the lake shore, after which we returned to Marsabit. We intended to go to the west side of the lake, where it would be possible to launch a boat and so make a search of the shore and the island. Half an hour before our departure a wireless message was received from Lokitaung saying that two signal fires had been seen on the opposite (east) side of the lake. Two hours later we left for the indicated point, 250 miles to the north, with a police patrol under Assistant Superintendent of Police, Mr. Holmes. A third aeroplane was ordered to



Sketch-map to illustrate the various search journeys undertaken

search that area. On August 27 we reached the spot indicated from Lokitaung and found the remains of the fires in question. It was plain that they had been lit by natives, and we turned back certain that the last chance of finding our companions alive was gone.

As we felt that some traces of what had happened might be found on South Island we arranged to transport a boat lent by the Kenya and Uganda Railways and Harbours, from Lake Victoria to Lake Rudolf. In this MacInnes and myself sailed southwards for eight days. Owing to Government instructions

issued from Nairobi we were compelled to follow the weather shore instead of being able to travel south under the lee of the east coast, with the result that one night the boat dragged her anchor and sank on the bouldery shore. After she was mended we were still delayed many days by weather and the bad fever from which MacInnes was suffering. Finally we were compelled to make a one-day dash for the island; all went well till we had covered 15 miles of the 20-mile crossing, when a strong wind began to blow directly off the island. Half an hour before darkness fell the outboard engine was swamped for the third time and we were compelled to turn before the wind when only 2 miles from the island. Five hours later we beached the boat successfully on the western shore.

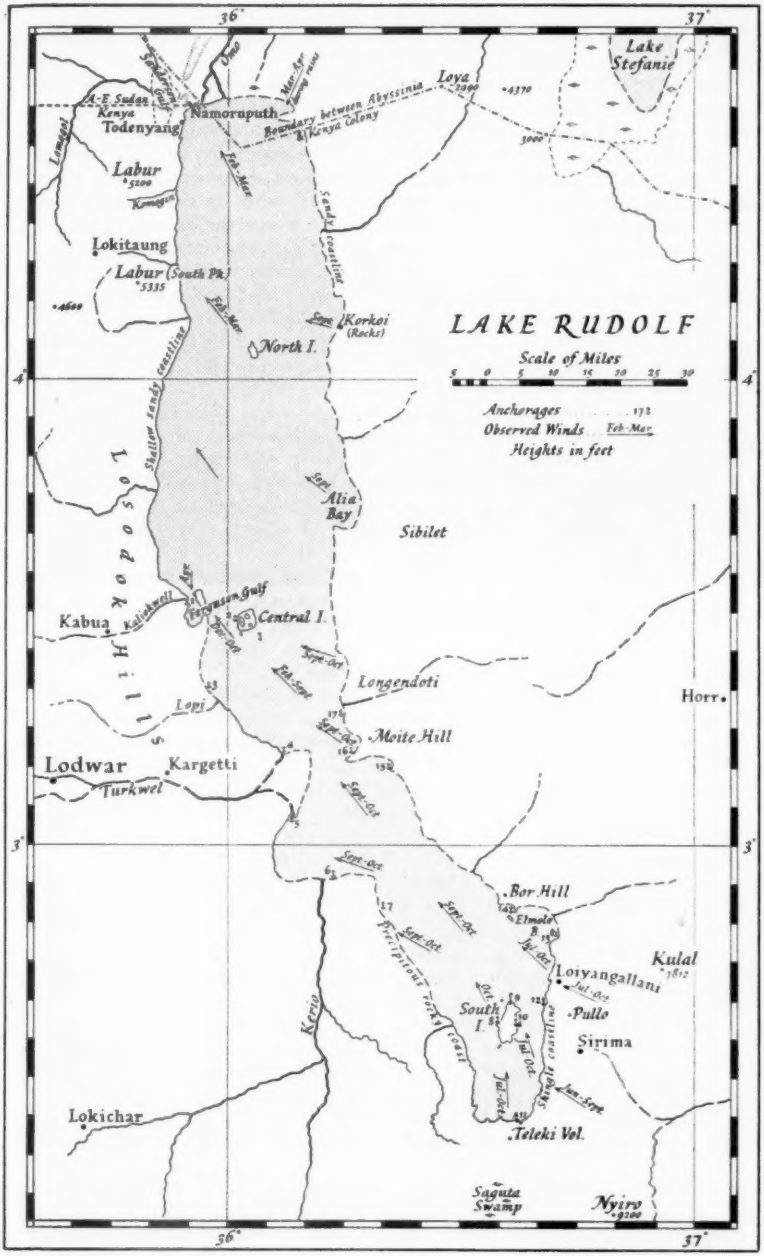
Lack of petrol and supplies forbade that we make another attempt; so ended our search for any signs of what had caused the accident to our two companions. During the search two tins, two oars, and Dyson's hat were found on the west shore of the lake, the latter being nearly 70 miles north of what must have been the scene of the accident. Not the least mysterious aspect of the whole affair was the disappearance of the boat and the two 4-gallon buoyancy drums that were carried in it.

Dyson, as our medical officer, not only looked after the European and native personnel of the expedition, but he also spent a great deal of time attending to the sick of the tribes with whom we were in contact. His zoological work, which he pursued with such determination, has resulted in a fine collection of specimens; while the anthropological measurements and notes which he made of the Turkana and the Elmolo will be of the greatest value. The latter were of particular interest to him from the orthopaedic point of view, a work in which he specialized.

Martin, who was an American citizen, joined the expedition as a surveyor. During the first months he worked in conjunction with Wakefield, but latterly he was compelled to carry on alone, which he did with enthusiasm and success under the most trying conditions. It was in the course of this work, the surveying of South Island, that he lost his life. His training as a forester and his keenness for the subject led him to undertake the collection of botanical specimens throughout the expedition. It is impossible for me to express myself adequately, but every member of the expedition will wish me to voice publicly the deep feeling of loss which we all have suffered with the passing of these two companions who had endeared themselves to us in the few short months we were together. I am glad to say that work has already begun on the valuable notes and collections made by these two men, so their last work will not have been in vain.

Finally I would like to record my appreciation and thanks to every member of the expedition for the loyal and unselfish manner in which they have worked to bring it to a successful conclusion. I am convinced that there has never been an expedition whose members have worked in greater harmony than did my companions in 1934. Though the last two months of the programme were uncompleted I think I may say that the results obtained, prior to the tragedy, have justified the undertaking.[1]

[1] *Author's Note.*—All photographs without initials were taken by the author: those marked W. R. H. M. were taken by Mr. Martin, that marked J. F. M. by Mr. Millard.


36°
37°
4°
3°
LAKE RUDOLF
Scale of Miles
5 0 5 10 15 20 25 30
Anchorages
Observed Winds Feb-Mar
Heights in feet
Lake Stefanie
Loya 2900
4370
3000
Boundary between Abyssinia & Kenya Colony
A-E Sudan
Kenya
Namoruputh
Todenyang
Longipi
Labur 5200
Kumogin
Lokitaung
Labur (South Pk.) 5335
4600
Feb-Mar
Korkoi (Rocks)
North I.
Sandy coastline
Shallow sandy coastline
Losodok Hills
Alia Bay
Sibilet
Kabua
Kalokwell
Ferguson Gulf
Central I.
Longendoti
Horr
Lopi
Moite Hill
Lodwar
Kargetti
Turkwel
Bor Hill
Elmolo
Kulal 7612
Loiyangallani
Pullo
South I.
Sirima
Kerio
Lokichar
Teleki Vol.
Saguta Swamp
Nyiru 9200

APPENDIX I: SURVEY

R. C. WAKEFIELD

A word or two is probably necessary to explain the present state of the maps of the country west of Lake Rudolf. A large amount of sketching and rough plane-table work has been done by various people, but attempts to co-ordinate it with the bounding surveys have all failed. The reason has been that over all that area there has been no fixed point or framework of connected points whose accuracy could be relied upon. Mount Labur, with its most conspicuous conical summit, is the key point to positions on the west of the lake and a summary of the various values that have been attributed to it may not be out of place here.

In 1902–03 Captain Maud, R.E., worked south from Addis Abbaba by latitude and azimuth and a rough triangulation, and found Labur to be longitude 35° 47′ 52″. He accepted a longitude for Addis Abbaba based on a rough connection to two points on the Sudan frontier which in turn were roughly connected with the longitude of Khartoum. This agreed roughly with an absolute value derived by Major Swayne at Addis Abbaba in 1897.

In 1908 Major Gwynn made an observation for longitude at Dire Daua based on the transport of chronometers from Jibuti, and accepting the chart value of the longitude of Jibuti. This resulted in Addis Abbaba being changed by +98 secs. and resulted in the longitude of Labur being changed to 35° 49′ 30″ (see *Journal*, August 1911 and November 1913). Subsequently the chart value of Jibuti was found to be wrong and was corrected by −33 secs., thus making Labur 35° 48′ 57″.

Now Archer in 1909 made a rough connection by triangulation between the Kenya main triangulation and three points common to Maud and Gwynn. He found Maud's original values an average of about 40 secs. west of his and Gwynn's corrected value some 25 secs. farther east. If Archer's longitude were accepted the longitude of Labur would be 35° 48′ 33″.

Captain Kelly's work in the Sudan, based on the longitude of the Lado Enclave by Coningham, joined on to Gwynn's at two points and was found to be 64 secs. farther west than Gwynn (corrected), thus agreeing with Maud's original values. Later the longitude of the Lado Enclave was altered by +8·2″ as a result of Mr. Wade re-observing the longitude of Khartoum.

In 1919 a mean value was adopted for Labur of 35° 48′ 17″, based on weighted results as follows:

Maud 3, Gwynn (corrected) 2, Sudan (uncorrected) 3, Archer 4.

After further correspondence between the War Office, the Surveyor-General in Nairobi, and the Director of Surveys in Khartoum, a final value for Labur was adopted in 1920 of 35° 48′ 22″, the weights having been changed to Maud 3, Gwynn (corrected) 2, Sudan (corrected) 1, Archer 4.

Subsequently I understand that the accepted position for the longitude of Labur by the Kenya Survey Department has lately been 35° 49′ 30·1″.

It was the result of this uncertainty in absolute position that made it essential to establish a framework of astro-radio positions for the area. Three main stations were occupied and three to four nights were spent in star observations at each point. Only a 3¼-inch instrument was used, but the individual results of each observation agreed very satisfactorily. A small portable wireless set was used at each station for the reception of time signals. The positions fixed were as follows:

	Latitude	*Longitude*
Labur summit	04° 24′ 35·4″	35° 48′ 49·4″
Kaitherin summit	04 47 14·3	35 15 50·7
Lodwar summit	03 09 36·6	35 35 20·0

Looking north from above Teleki's volcano: South Island in the distance

Looking east from the top of South Island, the Kulal mountains in the distance

Looking north from the north end of South Island

The N.E. bay of South Island

It is interesting to note that the difference between the longitude of Labur as deduced through Kelly's work based on the Lado Enclave and the new value is 48 seconds, whereas in 1929 Mr. Sweeting re-occupied Kelly's Latuke when carrying out a triangulation based on the Uganda main chain and differed from Kelly by 58 seconds in a similar direction.

Only two values have been derived for the latitude: Maud's original one which was used by Gwynn of 04° 24′ 30·2″ and one derived through Archer's work linking up the main Kenya triangulation with that of Gwynn which was some 10 seconds greater.

Assuming the new position of Labur it would appear that the following corrections would have to be made to previous work:

Maud	+57
Gwynn (corrected)	− 8
Sudan (corrected)	+47
Archer	+16

Azimuths were observed from the summits of Labur and Kaitherin.

The Azimuth of Kaitherin from Labur is 124° 29′ 11″ S. by W.

" " Labur from Kaitherin is 304° 26′ 41″ "

The Azimuth Labur to Conical Hill was also observed to compare with that which had been used in the computation of Gemmel's triangulation and taken from Gwynn's work. The new value is 135° 10′ 06″ S. by W. as opposed to Gemmel's 135° 42′ 50″.

Unfortunately conditions both on Labur and on Kaitherin were bad. A high wind blew almost continuously and visibility was extremely patchy. Rounds of horizontal angles were taken and a number of more important vertical angles, but it was unfortunately not possible to take any vertical angles to the hills to the west of Kaitherin. The observations at Lodwar were taken on the plain in perfect conditions and later transferred by a measured base, an observed azimuth and a single triangle, to the summit cairn.

While at the camp at Todenyang on the north-west corner of the lake, a base-line 3½ kilometres long was measured along the shore, with a steel band to enable an accurate determination to be made of the height of Labur above the lake-level. The mean observed height proved to be 3628 feet above water-level, and an iron post was cemented into the rock about 300 yards south-east of the fort to mark the water height on that date. The War Office map of 1903 shows the height of the lake to be 1250 feet, the result of Major Austen's work. This was apparently a mean of many hypsometer readings taken along the shore. Mr. Champion shows 1230 feet on his 1933 map, apparently accepting Austen's work and allowing for a drop in the lake-level of 20 feet. Gwynn in 1911 shows 1560 feet as a result, I believe, of a triangulated height. Gwynn's difference in height between the lake and the top of Labur is 3640 feet as compared with our 3628 feet. For the moment 1230 feet may be assumed as a rough value for the height of the lake, thus making Labur some 4860 feet above sea-level.

Detailed results of certain observations have still to be compiled and the results which Mr. Martin left of observations to the south-east of the lake in the neighbourhood of Kulal have yet to be examined. A plane-table survey was made of Ferguson Gulf, to compare with previous sketches which had been made.

APPENDIX II: ARCHAEOLOGY

J. F. Millard and V. E. Fuchs

The expedition originally intended to visit the known fossiliferous Pleistocene deposits of the Omo river with the object of finding remains of early human

cultures which it was thought should occur in them. As permission to enter Abyssinian territory was not forthcoming, our attention was turned to similar deposits along the west side of the lake. Though the beds which we were able to investigate were not rich from the palaeontological point of view, our expectations of finding human cultures in the area were justified. Indeed the Lake Rudolf basin would appear to have been inhabited almost continuously from the earliest Chellean times to the present day.

In common with the rest of East and Central Africa the Lake Rudolf region has had alternating wet and dry periods with accompanying variations in the extent of the lake. The greatest extension would appear to have occurred during the early Upper Pleistocene, after which there has been a steady retreat, with minor fluctuations, to the present day.

It is in or on the old lake beaches that the majority of the tools representative of past human cultures are found. They are also found in the vicinity of waterholes, many of which have been permanent from at least as early as Neolithic times to the present. The earliest cultures found in the area occurred to the east of the Losodok Hills, which probably formed a chain of islands during Chellean ages. At that time the lake seems to have been falling and it continued to do so during the Acheulean, for on the whole the representatives of this culture were found nearer the present lake than the earlier types. After the Acheulean the lake rose steadily to its maximum extent, which would appear to have occurred during the Gamblian period. The cultures representative of the Gamblian, *i.e.* Mousterian and Aurignacian, are both represented in the country west of Rudolf, but the Mousterian predominates. As the Aurignacians appear to have been a cave-dwelling people it is likely that the absence of suitable dwelling sites was the cause of this predominance.

At the close of the Gamblian the lake had already been reduced, in fact to such an extent that the valley between the Kaitherin range and Lorienatom was already dry, for a living site of the Magosian people was found at Naramum, in close proximity to the waterhole.

It may be that when the series of cultures recovered from the Lake Rudolf basin are properly studied, in the later types at least a western influence will be seen to have affected the cultures. In any case the collection from this area is of interest; for as it extends northwards there appear certain of the types known to occur in southern Kenya and northern Tanganyika, and thought by some to have evolved from the most primitive form in the eastern part of the Central African Province. Then too the Rudolf basin is the meeting point of the three roads which were the most likely to have been used by the migrating peoples of different cultures. Thus from the south *via* the chain of lakes on the floor of the main Rift Valley; from the north-east (Red Sea and Arabian direction) by a similar series of lakes in the Abyssinian Rift; thirdly from the west and north along the Nile from Egypt and so by its one-time affluent from Rudolf, into the lake area

APPENDIX III: GEOLOGY

V. E. Fuchs

It would be premature to give here anything purposing to be the results of the geological work, but it may be of use to mention briefly a few of the outstanding points about the geology of the area as a whole.

In the first place, Lake Rudolf undoubtedly lies in the northern extension of the eastern branch of the Great Rift Valley of East Africa. From Lake Baringo northward the course of the Rift may be followed clearly enough, but from Mount Nyiro at the south end of Lake Rudolf the east wall of the Rift is difficult

to follow and appears to die away altogether. On the other hand the western wall continues northwards, forming the west boundary of the lake at its southern end, then it too is discontinued in the direct line. Nevertheless it can be seen to be taken up by the more westerly fractures of the Sekerr–Chemerongi escarpment that continue as a prominent feature as far as Mogilla mountain to the far north-west.

From the work of the expedition it appears that the country to the east of this outer escarpment on the west of the Rift Valley is composed of the old peneplain surface that existed prior to the Rift fractures. In Central and Northern Turkana this surface has been flooded at intervals by basaltic lavas (in the north-west by rhyolites) from the early Miocene onwards. Earth movements continued during the Miocene and Pleistocene, for the early Miocene lavas and tuffs are folded by pressure in an east–west direction. Thus, taking the lake as a central line, we found that the folds on either side were overfolded towards it. In the east and south of the area these movements appear to have been accompanied in the Pleistocene by the further extrusion of lavas. The most recent activity has been recorded, by von Höhnel and others, during the last fifty years in the Teleki volcano region at the south end of the lake.

The evidence of the old lake beaches of Rudolf shows that not only did the surface of the lake once lie at least 350 feet higher than at present, but that it also occurred at a lower level than that at which it now lies. Owing to subsequent obliteration of the evidence it is not possible to say to what extent the early Pleistocene lake spread over the country, but it is probable that the greatest area was attained during the lower part of the Upper Pleistocene. At present this view is founded upon the evidence of human cultures in the lake deposits.

Certain molluscan fossils found interbedded with the Pleistocene lavas on the east of the lake may on further examination be found to be of a different fauna from that at present inhabiting the lake. This would exclude the Rudolf region from the Nilotic Faunal Province during the early Pleistocene. In that case it would probably prove to have been part of the Central African Faunal Province, being related to the now extinct molluscan fauna found in the Kaiso deposits of the lakes of the Western or Uganda Rift Valley.

At the present time the silting up of Lake Rudolf together with the steady fall of the water-level combines to cause a rapid reduction of the lake area every year. Also the time is in sight when the Turkwel river delta will link with the sandspit running far out into the lake from the foot of Moite Hill on the east shore, thereby dividing Rudolf into two basins. When that has occurred it will be but a comparatively short time before the southern lake dries up in the same way as that which once occupied the Sugota valley south of Lake Rudolf. One further step will then have been taken towards the complete desiccation of the area.

APPENDIX IV: ORNITHOLOGY

D. G. MacInnes

The aquatic or semi-aquatic birds of Lake Rudolf were amongst the most interesting observed, and some useful notes were made concerning migration, nesting, and other habits. Many European species occurred on the lake, and remained there throughout the year; these included the Common Curlew, Ringed Plover, Common Sandpiper, Marsh Sandpiper, Green Sandpiper, Curlew Sandpiper, Little Stint, and several small passerines.

The Shoveller (*Spatula clypeata*. Linn.) and the Gargany Teal (*Anas querquedula*. Linn.) were the only European Ducks seen in the area, and these

left on migration during the first week in May, returning in the last week of September. During their absence their place was taken by the White-faced and Fulvous Whistling Tree Ducks (*Dendrocygna viduata*. Linn.), and (*D. fulva*. Gmel.), which were absent throughout the other part of the year. It might seem that there exists some mutual antipathy between the species, or else that some peculiarly happy agreement has been reached concerning the lake's food supplies.

In the spring months the Gull-billed Tern (*Gelochelidon nilotica*. Gmel.) occurred in fair numbers, though always singly, and was found to be in full breeding plumage, a condition hitherto unrecorded in Kenya. In October they were more numerous, and frequently in large flocks. The White-winged Black Tern (*Chlidonias leucoptera*. Temm.) also occurred in great numbers, and though many attained breeding plumage in April, no signs of nesting were observed. At that time of year these Terns fed almost exclusively over the water, whereas in September the majority appeared to be feeding on grasshoppers farther inland. Scissor Bills (*Rhynchops flavirostris*. Vieill.) were first seen towards the end of April and began nesting operations immediately. They were still present in very large numbers in October, and by then the young were all fully fledged. This seems to be the first record of their breeding.

Many birds were found to be still nesting on Central Island at the end of September, particularly the Wood Ibis (*Ibis ibis*. Linn.), a large colony being observed on September 26. Unfortunately time did not permit a close examination of this nesting site, but many birds seemed to be sitting on eggs, whilst in some cases young could be seen. This is the first nesting colony of the Wood Ibis recorded in Kenya.

On a single day two unfledged pelicans were found in a nest situated in a low tree, and also a pair of adult birds were seen collecting nest materials. Young of the Goliath Heron (*Ardea goliath*. Cretzchm.) were found in April and again in September, in both instances the nest being placed on the ground, contrary to the usual procedure amongst Herons. Enormous numbers of birds, notably Pelicans, Cormorants, and Herons, gathered on Central Island every night, where they roosted in the trees and bushes, possibly to be out of reach of crocodiles.

Skins of about one hundred species were collected and presented to the Coryndon Memorial Museum, Nairobi. A complete list of these, together with detailed notes on habits and distribution, has been published in the Journal of the East Africa and Uganda Natural History Society. (Vol. xii, nos. 1 and 2.)

APPENDIX V: NOTES ON THE NAVIGATION OF LAKE RUDOLF

V. E. Fuchs

These notes are necessarily very incomplete, as only a small part of the expedition's time was spent on or near the lake: but it is hoped that they will be of use to any one proposing to use a boat on Lake Rudolf in the future.

There are few points at which it is possible to launch a boat of any size greater than can be carried by hand for many miles. The most suitable places are Ferguson Gulf and Todenyang, for both these points on the west shore can be reached with lorries. On the east side of the lake probably the only suitable point for launching a boat is at Alia Bay, where it is also possible to reach the lake with lorries, but in this case with much greater difficulty.

As with all inland waters, Lake Rudolf is subject at times to extremely violent storms accompanied by large white-capped waves with an unusually short distance between crest and crest. Though these storms arise very quickly, they

never, in our experience, did so in such short times as a quarter of an hour or twenty minutes, as is often stated. Like estimates of speed, unless times are actually noted the impression received often induces a very great error. As a result of watching the conditions for many weeks we became of the opinion that really bad conditions did not arise in less than two hours, starting from a flat calm. Nevertheless it must be remembered that if a fair wind is already blowing it certainly does take a comparatively short time for dangerous conditions to arise.

Prevailing winds

The most striking thing about conditions on Lake Rudolf is the constancy of the prevailing wind from the south-east. This is shown by the arrows on the map. Since the expedition was constantly on the move the wind directions are marked with the months in which they were observed by us or by previous expeditions. It is thought that throughout the area the winds are nearly constant all the year round, with perhaps the exception of the north or north-east wind from the Abyssinian highlands, which seems to occur only during March and April and to bring with it what scanty rains the area enjoys. There is in nearly every month of the year a periodical light air from the north which occurs after the afternoon calm and before the south wind rises again. In September and October we found this light wind sufficient to cause cross-waving with the remaining swell from the south, making conditions unpleasant for a small boat.

It is at the south end of the lake that the most violent conditions are experienced. There a tremendous east wind may sweep down over the Sirima scarps on to the lake. This, combined with the wind from the south of the lake, causes a heavy cross sea which in October prevented our search party from reaching South Island. During that attempt it was thought that once the lee of the island was reached the last mile or two would be in sheltered water. This proved to be wrong, for the violent down current from the western slopes of the island whipped the lake surface into white horses only a few hundred yards from the shore

As one travels northward the direction of the wind appears to swing gradually eastward, though on the west shore the southern component is well maintained. Dr. E. B. Worthington reports that in the Moite Hill [1] region the easterly gusts are very tricky, since they may swirl round the hill on either its north or its south side.

It almost appears that the general direction of the wind is governed by the form of the lake, for the tendency is for the most constant winds to blow in a north-north-west direction.

Anchorages

The anchorages are marked on the map by numbers from one to seventeen. In most cases these have been used, but if only observed as suitable points, this fact is stated.

1. *Ferguson Gulf.*—The best point is in the mouth of the Kaliokwell river, where there is complete shelter and a mud bottom. On the inner edge of the sand-spit itself there are numerous small bays with deep water right up to the shore, but with the exception of the river the mainland shore is muddy and the water very shallow. There is often a local north or north-east breeze in the Gulf itself, which is not apparent in the open lake.

2. *Central Island.*—On the west shore of the island a small sand-spit gives shelter from the prevailing wind, though underwater boulders necessitate a

[1] Sometimes called El Moitat.

careful approach. There is no other suitable anchorage round the shores of the island. The wind is almost invariably off-shore.

3. Some 5 or 6 miles south of the base of Ferguson spit some cliffs may be seen near the shore. A mile or so north of these one or two small sand-spits give sheltered water of 2 or 3 feet depth. These spits should not be relied upon owing to fluctuation in the level of the lake.

4. *North Turkwel Mouth.*—A small bay formed by the extension of the Turkwel delta. The water is shallow with a sandy bottom but is very well protected from the south wind. A Turkana village is situated in the bay.

5. *South Turkwel Mouth.*—Once over the sand-bar, shelter is found in the extensive shallows beyond. There occur innumerable mud-banks and deep channels beset with snags in the form of tree-trunks and vegetation brought down by the flooded river. A boat of 2 feet draught has to be left half a mile from the shore.

6. *Kerio River Mouth.*—Approximately 1 mile east of the Kerio river mouth there is a stretch of sandy coast well protected from the prevailing wind.

7. About 4 or 5 miles south of the most easterly point of the Kerio sand-spit there is a series of curved sand-banks just awash (subject to fluctuations of the lake). Behind these underwater weed grows in 3 feet of water. There is complete protection from the open lake.

8. *West of South Island.*—A long shingle beach was seen from the island to afford some protection from the prevailing wind. This anchorage was not used and the holding is doubtful as there is probably a shingle bottom.

9. *North Bay South Island.*—This bay on the northern end of South Island was never visited in a boat but appears to be well sheltered. The water is probably deep and the bottom a hard volcanic ash. It is doubtful whether it would be possible to climb up the cliffs out of the bay.

10. *East Bay South Island.*—This is a small cove on the main island which is sheltered by the low islet that lies to the east. The water is deep right up to the shingle shore. The bottom is shingly or rocky and there are numerous underwater snags in the vicinity. Particular care should be taken in entering the channel between the two islands.

11. *Teleki Creek.*—At the extreme south end of the lake and to the east of the conical crater standing out in the water there is a long narrow creek. The rest of this coast is dangerous, but shelter could be had in the creek where there is a muddy or rocky bottom. This point was never visited by boat.

12. *Crater Bay.*—About 4 miles south of Loiyangallani on the east shore of the lake and a little north of a point opposite the middle of South Island, there is this well-sheltered bay formed by an old crater. The water is shallow close to the shore, the bottom being muddy or sandy.

13. *Elmolo Bay.*—Between the only remaining Elmolo island and the mainland there is a stretch of sheltered water which should afford a good anchorage. We ourselves always beached the boat.

14. *Bor.*—In the region of Bor Hill there is an Elmolo village on a spit which stretches out towards a small rocky islet. This was only visited on foot, but it seems that a certain amount of shelter would be found. The water is rather shallow and the bottom sandy.

15. At a point some 4 miles south of Moite Hill a small rocky island has become connected with the mainland by a shingle spit which now affords shelter from the south-east wind. This was visited by boat but not used as an anchorage. The bottom is probably shingly. The place can be located from the water by a white rock which is visible at a distance of about 2 miles.

16. Dr. E. B. Worthington in 1931 used the north side of the Moite spit as an

anchorage. He found it well sheltered from the prevailing winds, and in a number of places the boat could be brought right up to the sandy shore.

17. Worthington also found several miles north-west of Moite a stretch of shore-line with numerous small sand-spits giving shelter for a small boat. One was used by him during his journey.

In 1934 we observed that Alia Bay has been much reduced in size owing to the fall of the lake-level. The shore from the south point of Alia Bay to Korkoi is shallow and muddy and it is probably the same as far as the north end of the lake. Korkoi is recognizable from a small group of rocks that appear like monstrous rounded boulders a few hundred yards from the shore.

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: We are to hear to-night of the "Lake Rudolf Rift Valley Expedition of 1934." For many years past we have been hearing a great deal of the famous Rift Valley in Central Africa, which was written up so ably and scientifically by the late Professor Gregory. There is still an enormous amount of work to be done in that region. The primary object of the expedition about which we are to hear this evening was to continue the geological survey of the Lake Rudolf basin in the great Rift Valley. The leader, Mr. Fuchs, who will read the paper, is a research student at Cambridge, working for a degree in geology, and the expedition was a small one of six young men. Three of them are with us this evening. Mr. Millard, the fourth, is away in South Africa, and two others, alas, Dr. Dyson and Mr. Martin, are not with us by reason of the great tragedy in which they lost their lives, and on account of which the latter part of the programme had to be abandoned. I do not intend to say more on that subject at the moment, but will ask Mr. Fuchs to read his paper.

Mr. Fuchs then read the paper printed above, and a discussion followed.

The PRESIDENT: Mr. Wakefield and Mr. MacInnes, members of the expedition, are both with us. I will ask Mr. Wakefield to say a few words on the subject of the survey work of the expedition.

Mr. R. C. WAKEFIELD: I am afraid I can say very little after what our leader has told you, except as to the detailed part of the survey in which most of you will probably be little interested. As you must realize, when one goes into lands which have had little investigation, there is so much to be done, so many things one wants to do and so many which other people want one to do, that it is difficult to decide which should be attempted and which should be left for another time. I think, from a survey point of view, that was the hardest decision to take, and I should like to thank Mr. Champion, who has done so much work in Turkana Province, for his advice as to what we should try and do and what would be most useful for compiling future maps of the area. The result was that instead of re-doing certain work which had been done by different individuals beforehand but not yet collated, we set out to try to check questionable points by providing new absolute positions on which all the work of Mr. Champion and the officers of the King's African Rifles and of the various District Commissioners could be compiled and put on to one map. It was with that object that we decided to fix three or four main positions. Much time was spent in fixing these and we left out the detailed survey which could be so much better done by those who live in the country and who had better means of transport and more time than were available for us. The results, as far as they are known at present, agree within roughly half a mile at the key position of Mount Labur, the junction of several rough triangulations brought from Kenya, the Sudan, and Abyssinia.

There were two main objects of the survey: one to place positions on the maps and the other from the geological point of view to try to get a basic height for the area. The obvious height to fix was the height of the lake, which was roughly but not accurately known, and our only means of fixing that was by a string of instrumental angles, from the lake shore for some hundreds of miles westwards to where known heights actually occurred. We did three-quarters of that programme, but owing to the rains and the floods we were unable to complete the last link in the west. We have however got a height for Mount Labur and some of the surrounding hills with reference to Lake Rudolf. It is only now left for somebody to fix one height with reference to triangulation points in other areas.

Those were the two main things we set out to do, and it was naturally important that our main survey points should be within reasonable distance of camping grounds, which themselves had to be within reasonable distance of motorable tracks. The programme was more or less adhered to, but took considerably more time than was expected, and in addition, a new plane-table sketch was made of Ferguson Gulf for comparison with previous maps which existed.

Martin and I worked together all the time on the west of the lake, but when I had, unfortunately, to leave in the middle of the expedition, he continued and worked by himself on the south-east, as you have heard. I should like to say how invaluable his knowledge was, combined with that surveyor's gift of a methodical mind, in the carrying out of the survey work on the west coast. I understand that he had had little practical experience in surveying and none at all in the type of surveying we were doing, but his energy and his adaptability came to the fore, and he took up the work very quickly and became adept at the use of instruments on the darkest of nights. If any value can be assigned to the survey results which we brought back, they were largely due, I think, to Mr. Martin's even temperament and unfailing humour in conditions which, as you probably have realized from the lecture, were not always of the most pleasant.

The PRESIDENT: Mr. MacInnes is primarily a palaeontologist but he also interested himself in the ornithology of the region. As you will have remarked, the activities of the expedition were employed in various directions.

Mr. D. G. MACINNES: As you have already heard, the palaeontological side of the expedition was not really a great success. We knew of certain deposits of supposedly Miocene Age on the west side of the lake, where fossils had been obtained by the French expedition about two years before. Accordingly, we began our work there and after many days spent in searching for the site where the fossils had been obtained, we did actually find some of the diggings made by the French expedition, but either they had collected everything, or there had not been a great deal to collect. Practically nothing was to be found but a few fragments of primitive elephants and some few odd bones which have not been identified; also what appear to be a clutch of eggs of a turtle, several hundreds of thousands of years old, apparently, but fairly well preserved. These, I am afraid, are not of very great value from the scientific point of view.

It was while we were in this area amongst the hills on the west side of the lake that I was one day helping Mr. Fuchs by trying to do some geological work. He asked me while he was writing up some notes to take some compass bearings of certain fixed points round about. I am not a geographer, and I do not know anything about surveying, but I always have understood that the compass is used to some extent, and when Mr. Fuchs asked me to take the readings I did at least know how to do it. I took a reading at a certain point and told him the place was due north. He seemed rather surprised and said that that point was known to be almost due south of us! I then said I would look at the compass again and I took a bearing on the same point. It proved then to be due east! It

meant that either I was seeing things or the compass was, so I asked Mr. Fuchs to try. He made it due west! This may sound irrelevant, but it may give you some idea of another of the difficulties which the surveyors came into contact with, and I think it wonderful that they were able to carry out such very accurate work, as undoubtedly they did. I do not mean to cast any aspersions upon their work, but merely to show another of the troubles with which they had to contend.

Owing to the lack of fossils I took it upon myself to collect the birds of the area as far as possible, and made a collection mainly of the somewhat inconspicuous birds which had most probably not been collected before from there, but nothing of very great interest was found. A few very useful notes were obtained with regard to nesting habits of certain species. They began nesting when the floods took place and during that time quite a number of useful observations were made by various members of the expedition. But the full and completed results of the ornithological work have recently been published in the *Journal* of the East Africa and Uganda Natural History Society.

I should like just to add my deepest sympathies with the relatives of our two companions who were lost. We all became very fond of them and, seeing so much of them, we have all learned from their attitude in extremely difficult conditions, a lesson that we will none of us ever forget.

The PRESIDENT: Mr. Champion, Provincial Commissioner for Turkana Province, who read us a paper three months ago on the subject of Teleki's Volcano, is here, and it has been a pleasure to hear that Mr. Fuchs' expedition received such an immense amount of help and co-operation from him. I should be very glad if he would come up on to the platform and address us.

Mr. A. M. CHAMPION: I much appreciate this opportunity of welcoming Mr. Fuchs back here in England, and the members of the Cambridge expedition, and to congratulate Mr. Fuchs upon his very interesting lecture. As you can imagine, it is a particularly interesting one to me. I know that the work done was very considerable. I am only an amateur naturalist. By profession I am an administrator; occasionally during the twenty-five years I have been in Africa I have found time to indulge in my hobby.

It was a great pleasure to meet Mr. and Mrs. Fuchs and the members of the expedition and to have long chats with them. They told me many interesting things and I was glad to be able to offer them hospitality, advice and assistance. Any welcome to the other members of the expedition would be incomplete without mention of Mrs. Fuchs. She accompanied her husband to Kenya, and though she was not with the expedition very long I had the honour of escorting her and my cousin, who was staying with me, to Turkana country. Afterwards Mrs. Fuchs embarked on some expeditions of her own, and I assure you they were extremely enterprising ones. She went as far as the Mountains of the Moon, the Mfumbiro volcano, and into the Belgian Congo; climbed one of the active volcanoes, Nyamligara; and passed a night, if not quite at the summit, near the summit of this active volcano, with a few native carriers procured through the help of the District Commissioner in the Belgian Congo district of Ruchuru.

Mrs. Fuchs took with her a Ciné Kodak, and I look forward on some future occasion to having the opportunity of seeing some of the photographs she took.

As the President has said, I was Provincial Commissioner of Turkana Province, the area in which the expedition spent the majority of their time while in Africa. It is very pleasant for me and some of the other officers of the Province and friends of mine who are here to-night to meet Mr. Fuchs and the other members of the expedition on an occasion such as this.

As you can imagine, in my official capacity after four years in Turkana, I perhaps know better than anybody else the difficulties which these young scientists had to contend with. The terrible heat, the devastating dust storms, and the poisonous climate, together with the difficulties of travel, all combine to make life a very severe struggle. We, who have our stations to go to from time to time, find it hard enough, but they lived a camp life in these conditions for a long time. They had not perhaps all the opportunities and all the facilities of transport which we Government servants have, and I must say I admire the members of the expedition very much indeed. It is good to know that the young men in this country still feel the call to go out into those uttermost parts of the world and seek out the mysteries of Nature hidden behind that veil which sometimes is so difficult to penetrate.

As I stand here I feel perhaps that I may serve as a sort of link between them and those who have not been to those parts of the world. It is difficult, I assure you, even after having seen those excellent photographs this evening, to appreciate what a very bitter, hard, and relentless country lies round Lake Rudolf. I do not know the eastern side, but from the photographs we have seen I think the country on that side must be as bad if not worse than it is on what I call my side. But you will be getting a wrong impression of Turkana. As a matter of fact, it is a very interesting country. The people are interesting, the geographical and other problems are interesting; interesting, that is, to those who have eyes to see. That is the great thing. And when trained scientists go out they see so much more than we do. That is what makes their visits so welcome. They can show us the things we have looked at day after day and have become so accustomed to that we do not appreciate them to the full. The scientist comes and points out something, so that what has been looked at every day and has become a commonplace, immediately becomes an object of great interest.

As you have seen, the expedition was not only hampered by climatic conditions, heat, sand, and desert, but also by floods. Floods, I assure you, are very unusual in Turkana. We are always very glad to see them when they do occur. Perhaps Mr. Fuchs and the other members of the expedition do not agree with that point of view, but at other times, perhaps, when they were living on 1½ gallons of water a day they would have welcomed a flood. But it never does things by halves in Africa, especially in the Lake Rudolf area. It either rains or it does not, and when it does not it sometimes does not for three years. In Lodwar, where the rainfall has not exceeded 1½ inches a year for the last three years, day after day we hoped for rain to freshen the arid region around. Alas, these floods were not caused by local rain, but by that which fell in such abundance high up on the Uganda Plateau, the land of the Karamajong on which the Turkana and their stock cast such covetous eyes.

To us, after our close association with these seekers after Nature, the shock therefore was the greater when we heard of the tragedy which had befallen the expedition. Mr. Fuchs, I am sure, knows well that we Government people did all we could directly we heard, and I would take this opportunity of assuring him again and all of you, that all that was done we did in the hopes that we might find some traces of the circumstances under which the two men lost their lives. I would add to my congratulations to the expedition my heartfelt sympathy with Mr. Fuchs, the members of the expedition, and the relatives and friends of those who lost their lives in such sad circumstances. Dr. Dyson and Mr. Martin were heroic, brave men, and they died trying to lift the veil of which I have already spoken, which is often such a heavy one. But such is the mission of men in this world.

The PRESIDENT: Sir William Gowers, would you give us a few words of

comment? Sir William Gowers, now Crown Agent for the Colonies, was, as you know, a great figure both in Uganda and West Africa.

Sir WILLIAM GOWERS: It is rather late for me to attempt to inflict anything of any length upon you, but there are one or two points which I have in mind to ask the lecturer. He did not tell us how deep Lake Rudolf is. The question of the depth of these Rift Valley lakes is interesting. Some of them are very deep; some not deep. I am not quite sure myself in which category Lake Rudolf should be put.

We did not hear very much about the fauna. I do not know, for instance, whether Lake Rudolf is full of crocodiles or not. Some of the Rift Valley lakes are and some are not. Are there hippopotamus, and if so what do they feed on? I should like to take the opportunity of congratulating Mr. Fuchs and the other members of the expedition on their work, because, in the first place, I was an old friend, with my father, of Professor Gregory, whom the lecturer mentioned. We had a great admiration for him. He was one of the great men of his generation. Secondly, although I have not seen Lake Rudolf I have seen the hills round it and perhaps a little to the north of the lake, and at the escarpment on the west of the lake. I have been down the Turkana valley, which has been so graphically described. I can certainly bear out what Mr. Champion said when he said the Turkana often cast covetous eyes on the grazing and watering-places of the people who live at the top of the escarpment. I do not want to revive any ancient quarrels now, but I must say I think they did a little more than cast covetous eyes. I remember a long conference of aged respectable gentlemen from each side of the boundary that took place on the top of the escarpment, arguing for hours and hours how many cattle each side should pay in respect of so many people who had been killed twenty years before.

I will only add how deeply I sympathize with the disaster which befell Mr. Fuchs' expedition through no fault of his own. I sympathize all the more because I have so often been frightened out of my life on Rift Valley lakes. On Lake Albert, for instance, sometimes a storm can get up quite suddenly that I suppose nothing but a sea-going boat could cope with. Anything else might be overwhelmed.

I again thank Mr. Fuchs on my own behalf and leave him to answer the one or two questions I have ventured to raise.

Mr. E. R. WORTHINGTON *sends the following contribution to the discussion:*

In the short space available Mr. Fuchs has not been able to say much about the biological investigations made by his expedition, but I feel these are sufficiently important to warrant a few remarks on how the biological results are likely to fit in with and enlarge current ideas on animal and plant distribution.

Firstly on the distribution problem of aquatic animals the main result has I think been the further elucidation of the ancient history of Lake Rudolf. During the 1930–31 expedition we proved that Lake Rudolf had formerly been connected to the Nile when the level was much higher than at present. Fuchs' expedition has examined the old high-level lake beach at many places round the shore, and the study of country to the north-west, in the region where the ancient Lake Rudolf must have overflowed, has helped further to show the state of affairs at the critical period, which seems to have been the beginning of the Pleistocene.

The discovery of a fossil lake fauna to the east of the lake may introduce quite a new idea on this subject. Preliminary study has suggested to Mr. Fuchs that these new fossils are very similar to the peculiar and isolated "Kaiso fauna" from the Lake Albert basin. The existing fauna of Lake Rudolf is very similar to that of Lake Albert, but the new discovery may put the faunistic connection

very much farther back in the time scale than had been supposed previously. These new finds contribute materially to our knowledge of an ancient African fauna, part of which appears to have persisted to the present day in Lake Tanganyika.

Turning to the distribution of land fauna, the collections made from the Turkana desert in the 1930–31 expedition showed striking connections, not with the nearby desert regions of the Sudan, but with the much farther off Somaliland area to the north-east. The new collections which were made, specially by Martin and Dyson, are more extensive and from a much wider area. When they have been studied by experts it will be very interesting to hear if they bear out the previous conclusion or introduce new ideas. In spite of the tragedy, Martin and Dyson's work in the biological as well as in other fields will continue to bear fruit.

Mr. V. E. FUCHS: I am afraid Sir William Gowers has only drawn attention to one or two of my shortcomings and lack of description and information. I find myself very forgetful when addressing an audience.

As to the depth of Lake Rudolf, we do know as a result of Dr. Worthington's Expedition of 1930–31 that Lake Rudolf is about 240 feet deep in the region of Central Island, which lies almost in the middle of the lake. How much deeper it may be elsewhere, we do not yet know. It certainly appears to be deeper at the south end from the nature of the shore, and I suppose it to be so. We have not however taken any soundings and we cannot state anything definite with regard to that. The water is more potable at the south end, and one supposes that this may be due to its greater depth and lack of concentration locally through evaporation.

With regard to the fauna, I certainly should have mentioned that. Though we were not so much concerned with the lake fauna as Dr. Worthington's expedition had been, I should have said that it is of Nilotic type, showing that the lake was once connected with the Nile system. The fish in it are very interesting and have been fully described by Dr. Worthington. Lake Rudolf certainly contains crocodiles, unlike the more pleasant lakes of Uganda such as Edward and George. In the waters of Lake Rudolf one finds innumerable varieties of fish, including the great Nile Perch, also crocodiles, turtles, and hippopotamus.

The PRESIDENT: It remains to wind up the evening. We have had a very interesting paper. Mr. Champion has paid handsome tribute to the great work these young scientists do: one year in Lake Rudolf, another year in Greenland! As a matter of fact, Mr. Fuchs has been on expeditions to both regions, and so have two of his companions. You realize, I am sure, what a great national asset these young men are. But when they undertake these enterprising tasks of exploration one need not say that they take their lives in their hands exactly, at the same time they must take risks; and when your work takes you into competition with the forces of Nature—well, you cannot legislate for safety on all occasions. On this occasion, as we all learnt with such deep regret, two of Mr. Fuchs' gallant companions lost their lives, evidently while on a trip which might have been done dozens or hundreds of times without mishap. But, as the proverb has it, the pitcher that goes to the well is broken at last, and we can only offer our very deep sympathy to the relatives who lost their gallant sons or brothers, and to the comrades who valued their companionship so much. Having done so on behalf of the audience and of the Royal Geographical Society I ask you to join me in thanking Mr. Fuchs for a very interesting and valuable paper.

GRÍMSEY, NORTH ICELAND

D. B. KEITH AND E. W. JONES

GRÍMSEY is a small rocky island, lying some 30 miles from the north coast of Iceland, in latitude 66° 33′ N. and longitude 18° 0′ W. Most Icelanders know of it merely as an island where enormous numbers of sea birds breed, and it is these which have attracted nearly all its visitors. In 1820 Freidrich Faber, a German ornithologist, visited the island,[1] and he was followed the year after by F. L. A. Thienemann.[2] In 1826 a British fishing vessel was wrecked off the east coast of Greenland, and the crew reached Grímsey in the ship's boats, and continued to Akureyri on the north coast of Iceland, after a stay of a few days on the island. James Cumming, the ship's doctor, has left a short account of the houses of Grímsey in his 'Narrative of the Shipwreck of the *Jean* of Peterhead.' In 1884 Professor Th. Thoroddsen, the Icelander, visited Grímsey, and though he was only there for six hours his paper forms the most complete description of the island yet published.[3] Since then it has been visited by at least five ornithological expeditions, the most recent of which was the Cambridge expedition to East Greenland, which spent four days on the island in July 1933.[4]

The main object of the present expedition, which consisted of four members, was to study the fauna and flora of the island, and to compare them with those of the mainland of Iceland. A map of the island on a scale of 1 : 20,000 was also constructed. There were two previous maps. One, published with Thoroddsen's paper, was taken from a Board of Survey sheet with additions put in by eye. The other is that published by the Danish Geodetic Institute in 1933, on a scale of 1 : 100,000, and is thus too small to show the detail here required. The Iceland Steamship Company's boats, which leave Hull every fortnight, call at Siglufjörður, a small town on the north coast of Iceland, after a stop of four days at Reykjavik *en route*. We arrived at Siglufjörður on June 21, having travelled from England in the S.S. *Goðafoss*. Here we were delayed for a day by the weather, as it is not possible to land on Grímsey when the wind is between south and west. The next day we chartered a small fishing boat which took us the 40 miles out to the island in just under seven hours. We took with us sufficient food for our stay on the island, as we had been advised not to rely on the islanders for our supplies.

We wish to express our very sincere thanks to Professor Debenham for his invaluable advice and assistance; also to Brian Roberts, who visited the island last year, and greatly assisted in the organization of the present expedition. Our gratitude is also due to Matthias Eggertsson, the pastor of Grímsey, for the trouble he took to help us in every way during our stay on the island. To the Committee of the Gino Watkins' Memorial Fund we are also grateful for the grant awarded to us, and to Caius College, Cambridge, for further financial assistance.

[1] Faber (1822): 'Prodromus der isländischen Ornithologie.' Copenhagen.

[2] Thienemann (1824): 'Reise im Norden Europas vorzüglich in Island.' Leipzig.

[3] Thoroddsen (1901): "Et Besøg paa Grimsø." *Geografisk Tidsskrift*, vol. xvi.

[4] Roberts, B. B. (1935): "The Cambridge Expedition to Scoresby Sound, East Greenland, in 1933." *Geogr. J.*, vol. 85, no. 3, pp. 234–51.

The island of Grímsey, after the authors' survey

The climate of Grímsey is milder than its latitude would suggest.[1] July is the warmest month with an average temperature of 45° F. (Akureyri 50·7° F.), and March the coldest with an average of 26·2° F. (Akureyri 26·6° F. in March, and 25·9° F. in February, its coldest month). The average temperature of the year is 34·9° F. Drift-ice is only an occasional visitor to the island; the average sea temperature for March is 34° F., and for the year is 39·2° F. The average precipitation for the year is only 277 mms., with the maximum in August, September, and October. In winter there is seldom much snow, and it is unusual for the ground to be covered for more than a few days at a time. The average is twenty-nine days per annum with complete snow cover (Akureyri eighty-eight, and Husavík ninety-two). Though the actual rainfall may be low, this is compensated by an unusual amount of mist. An easterly or north-westerly wind, which is also the commonest, usually brings mist or rain, and the former more commonly. The rapidity with which the mist descends, together with the uniform gently undulating nature of the ground inland, often makes it extremely difficult to find one's way if caught at a distance from the camp or farm when the mist descends. With a westerly wind, dry and in summer warm weather is experienced. The average maximum temperature for July is about 59° F. It was a common experience for us to be working without coats, under a cloudless sky, and half an hour later, or less, to be dressed as warmly as possible, and the island to be enveloped in mist. Meteorological records were first kept on Grímsey by Pjeter Gudmundsson, who was the pastor there from 1868 to 1894, and since then by Matthias Eggertsson, who succeeded him in that office.

The main physical features of Grímsey are very simple. It is a long narrow island, about 3 miles from north to south, and 1 mile from east to west at the widest part. As one sees, on approaching it from the west, the land rises gradually from the low western cliffs to the summit of the island, which maintains a uniform height for the greater part of its length. To the north and south are low-lying headlands. That in the north, Eyjarfótur, is about three-quarters of a mile long and 200 yards wide, and, like the rest of the west coast, is bounded by low cliffs up to 50 feet in height. At the south is the bay Grenivík, the only place where the land slopes gently down to the beach with no cliffs whatever, and the narrow headland Flesjar, which is continued into the sea as a line of rocky islets. The west coast is very irregular. In many places it is eroded into narrow, deep vertical-sided inlets, or into isolated rocky stacks and islets. In addition to these small bays there are two much larger, Básavík in the north, and Sandvík farther south. The boulder beach at the foot of the cliffs shelves very gently, and it is only at Sandvík that anything larger than small rowing-boats are able to land. Here a small 90-foot wooden jetty has been constructed, but the bay is very shallow, and it is not possible for boats with a draft of more than a few feet to come alongside this even at high tide.

The cliffs of the east coast form a continuous lofty wall, for much of its length more than 300 feet high, broken only by a series of rifts. Of these,

[1] The figures in this paragraph are by permission of Thorkell Thorkelsson; and from *Veðráttan*, the monthly periodical of the Icelandic Meteorological Institute kindly made available by the Meteorological Office.

Kaldagjá, in Eyjarfótur, is the widest and is easily descended. Farther south is Almannagjá, down which one can with difficulty scramble to the beach; Handfestargjá, farther south again, is similar but cannot be negotiated without the aid of ropes; Hrútagjá a little farther south, is another similar cleft, but is much smaller, and opens out high on the cliff face instead of cutting down to the foot. To each farm belongs a stretch of these cliffs and the sea birds and eggs collected thereon. Various portions are named after the farmstead to which they belong, such as Sandvíkurbjarg, Borgabjarg, and Eiðabjarg. Extending from Básavík down the west coast and round to the south end of the island, is a strip of comparatively level land which slopes very gently up to about 70 feet. From this height to the 250-foot contour the land rises much more sharply. These steeper slopes extend down the centre of the island towards the south, finally bending eastwards until they are cut short by the cliffs of the east coast. Above the 250-foot contour again the land is relatively level, and forms a plateau occupying most of the eastern half of the island.

The main mass of the island is built up of basalt, which varies greatly in structure from place to place. In the south-west are areas of well-developed columnar basalt, while there are also several fan-shaped basaltic masses at the foot of the cliffs on the east coast. At the base of the basalt are beds of conglomerate, sandstone, and ash. These are best exposed on the west coast in Stekkjarvík, where they rise to some 30 feet above sea-level. To the south they sink, and are quite absent at the south end of the island. Some 10 feet of similar beds are also exposed on the east coast at the foot of the cliffs around Almannagjá. In places the basalt has a spheroidal structure; in other places it is vesicular, while there are several patches of a ferruginous rock.

There is only one major feature to complicate the structure so far described. The plateau is cut in two by a narrow valley, known as Görn. This valley, which runs south-south-east, is remarkably straight, and its eastern side is in exact alignment with Handfestargjá. To the north of Görn and Handfestargjá the summit of the plateau lies on the coast; the cliffs rise sheer to the highest part of the island. To the south the cliffs rise sharply to a few isolated peaks (Handfestarhóll, Vænghóll, Sigmundarhólar), the summits of which lie on the same level as the long stretch of coast to the north. But apart from these, which all lie close to the rift, this stretch of coast is lower; and the plateau forms an isolated mass which does not reach to the coast, but which is bounded on the west by Görn, and on the east by a rocky scarp, Grenivíkurás, parallel to the coast but some 200 yards inland. The Görn in its upper part has steep rocky walls. Its floor is occupied partly by areas of tall hummocks, and partly by a chain of flat-bottomed depressions. In the centre of the valley, one of these depressions forms Hólatjörn, the only lake on the island which has not been known to dry up. In its southern part the walls remain steep, but they are not rocky. Ultimately the valley opens out on to the lower slopes of the plateau near its southern end. Cutting into the steeper slopes where they bend eastwards are two short parallel valleys, Syðri-Gátdalur and Ytri-Gátdalur. They are water-worn; their floors descend in steps by narrow rocky gullies. Görn bends a little to the east, and opens into Ytri-Gátdalur; but it is a striking fact that the line of Handfestargjá and the northern stretch of Görn is continued exactly by Syðri-Gátdalur. Thus it seems clear that these mark

the line of a rift which cuts the island in two. It is also noteworthy that the line of Hrútagjá is continued by the scarp Grenivíkurás, and that this is parallel to Görn, so that this would seem to mark a second smaller fault of the same system.

It appears that Grímsey once formed part of a much larger land surface, and its major features were developed before its isolation by rifting and the subsidence of the surrounding areas. Subsequently the cliffs and bays of the west coast have been excavated by marine erosion, while on the east coast, judging from the distance to which low rocks are exposed by the tide, at least 100 to 150 yards must have been eroded away. Much of this erosion must be comparatively recent. There is an erosion platform at some 10 or 15 feet above high-water mark along parts of the west coast, and at Grenivík is a raised boulder beach at the same level. There are no traces of the 30-metre and 70-metre raised beaches which occur on the mainland unless they be represented by the more gently sloping land just below the 100-foot and about the 250-foot contours respectively.

It seems likely that the whole of the island was glaciated, but as the rock surface is almost everywhere covered with deep soil it is difficult to obtain evidence for this. Several boulders on Hrauntangi do however show deep striations, and on the coast near Básar and near the lake at the mouth of Ytri-Gátdalur, are rock exposures which from their gently rounded surfaces appear to be glaciated, though here there are no striae. There are also a number of rock basins at the foot of the slopes on the flat western strip of land which may be the result of glacial action. There is a large group of these near the mouth of Ytri-Gátdalur; and one of them contains a shallow lake. There are more to the south-east and east of Miðgarðar, and there is another, also occupied by a lake, Sandvíkurtjörn, just north of Sandvík. It is also possible that the curious depression which extends eastwards from Hólatjörn may have been excavated by ice together with some of the other shallow valleys which cut into the slopes. Of these one of the largest and most interesting is Dimmidalur, which starts in the plateau near Hólatjörn and opens out on to the gently sloping land above the farm Eiðar. It has a broad shallow floor, much of which is occupied by tall hummocks, and which falls in irregular steps. On the steep slopes to the north of the upper part of this valley are several springs. Apart from one or two on the cliffs these are practically the only springs on the island, but by the end of June the largest of them had only the merest trickle of water which soon lost itself in the surrounding vegetation, while the remainder were little more than patches of moist earth. The drainage channels from these springs lead into a series of large flat-bottomed depressions of bare earth, surrounded by the hummocky pasture of the valley. These depressions do not lie in the bottom of the valley but form level terraces on the valley slopes. The lowest of the chain of depressions seems to be separated from the main valley by a low rounded dam of rock, suggesting that this curious drainage system might be explained by glacial action. It is also possible that the diversion of the Görn valley from its natural continuation, the Syðri-Gátdalur, into the Ytri-Gátdalur may also be due to glaciation.

The most striking of the remaining physical features of the island are the numerous flat-bottomed depressions which occur everywhere in great

numbers. These may be divided into two types. Some are situated in rock basins, and are for the most part marshes or shallow pools which are usually dry by September. In this class must be placed the lake in Ytri-Gátdalur, and the large depressions near the church. These have steeply sloping or even rocky sides. The other type is by far the more numerous. Each depression has a floor largely of bare earth, and dries up early in the summer. Sometimes these lie in the bottoms of larger valleys, as for example those in Görn, but most of them are found in the middle of an area of hummocks, and the only drainage into or out of them is formed by irregular winding channels among the hummocks. Often these form flat terrace-like patches on gentle slopes; several of them are on almost the highest part of the island, quite close to the edge of the cliffs. They are areas which become saturated with water during the winter and spring, perhaps when the subsoil is frozen so as to prevent subterranean drainage, and which for a time are shallow pools but which dry up rapidly with the onset of summer. There are only two wells from which drinking-water is obtained, one near the church at Miðgarðar and the other at Sandvík.

Soil covers almost the whole of the island to a depth of 4 or 5 feet. It extends without any decrease in thickness right to the edge of the eastern cliffs, showing that it was deposited at a time when the land extended much farther east, and has been eroded with the cliffs. In places it is much deeper: in one of the rocky basins near Miðgarðar there is at least 15 feet of soil, and there is a similar depth also in the well near the church. It is a rich brown, light in colour when dry; perfectly uniform, with no pebbles or stones and no fine stratification or bedding. It is only varied by thin layers of dark humus marking former vegetation levels. These do not seem to be continuous for more than short distances. It seems clear that this must be one of the wind-deposited soils made of volcanic dust which are widespread in Iceland.

It is not known when Grímsey was first inhabited; but the first reference to it in Icelandic literature is in the 'Heimskringlasaga'.[1] Here it is told how, in the year 1024, King Olaf of Norway tried to obtain a foothold in Iceland, and sent Toraren Nevjolvson to the *althing* "to beg of the Northlanders to give him an island or a skerry which lies without Eyjafjörður and is called Grímsey; in return for which he would send such goods from his land as the men might wish of him." This request was considered, and it was only after the patriotic speech of one Einar that it was refused. It was said that an army could be fed there, and if the island were to get into the hands of a foreign power, longships would be sent out thence to harry the mainland. Since then Grímsey has often figured in Icelandic history. It was here that the troublesome bishop, Guðmundur Arason, escaped and with him seventy armed men in 1222. He was attacked on the island by Sighvatur Sturluson, his men were slain and he was taken prisoner.[2]

In olden days the resources of Grímsey were greater than they are now. In

[1] Sturlason: 'Heimskringla' (English translation). Cambridge, 1932.

[2] This story is told in the Biskupa saga, but does not appear in the portion of that work translated into English and published under the title 'Stories of the Bishops of Iceland.' London, 1895.

A typical farm, built of turf and timber. Fish and meat are drying on the roof

The hummocks in the Görn valley. The ruler measures 24 inches vertically and horizontally

The cliffs at the north-eastern end of the island (Eyjarfótur)

Sandvik seen from Hrauntangi

The cliffs at the north-eastern end of the island (Eyjarfótur)

Sandvík seen from Hrauntangi

fact it seems probable that the island was inhabited very soon after the period of settlement in Iceland, for people were attracted there by the fishing, the sea birds, the drift-wood, and the seals. There are no records of famine, and people have gone there to escape from famines on the mainland. But with the coming of sealers to the Arctic a valuable source of revenue was removed; and whereas bears used often to be carried to the island on drift-ice they are now of no importance to the islanders whatever: the last one was seen there forty years ago. Perhaps partly for these reasons the island fell to a state of great poverty, and all visitors before the beginning of this century remarked on the "miserable want which seemed to prevail on the island." [1] At this time no ships ever approached the island, except rarely some Dutch fishermen.

The houses were partly subterranean: the flooring was of wood, the walls were constructed of an admixture of stones and mud, with a far greater proportion of the latter, and the whole was covered with turf. The entrances were long and winding, and the construction, though ill ventilated and lighted by only a few small panes of glass in the roof, was exceedingly warm. It is said that the entrances were built crooked as a protection against bears, which dislike following a winding passage. Despite the conditions under which they were living the islanders were repeatedly praised by travellers for their contentedness, a characteristic common to all Icelanders.

At the end of the nineteenth century there began a new period in the island's history. At this time a small coastal steamer began to call there, at first only twice a year, but later more frequently. By this means the islanders obtained small supplies of coal as well as numerous other commodities they were unable to obtain beforehand. For although the people from Grímsey used to go to Akureyri or Húsavik once or twice a year to sell at these places sea birds and eggs, the smallness of their boats made it impossible for them to bring back more than the barest necessities. Perhaps the most important reason for the new condition on Grímsey is that Professor Willard Fiske bequeathed a fund for the benefit of the inhabitants. On his death, in 1904, a trust fund of twelve thousand dollars was created, the income of which was to be "expended annually in ameliorating the conditions of the families inhabiting Grímsey, namely in improving the condition of the habitations and other buildings of the island, in contributing to the purchase of livestock, and supplies of fuel and hay, and in providing for the maintenance of a public library." [2] This legacy now brings in about 2000–3000 Kr. per annum (about £90–£140). With this money the houses on the island are being rebuilt, wood and concrete buildings being erected in place of the old turf and timber houses. There are now eight of these buildings; and eleven turf houses remain for future replacement. Cattle and sheep are bought for those who excel in cattle keeping. The little library, originally confined to chess books, is now well stocked with books of all descriptions, mostly in Icelandic, but with a few in Danish and English.

Formerly, the islanders were noted chess players, as the game was one of their few occupations through the long winter. But with the advent of the library, and also of wireless—for three of the farms now have their own receiving sets—interest in the game has waned and it is not now played so

[1] Cumming (1826): 'Narrative of the Shipwreck of the *Jean* of Peterhead.' Aberdeen.
[2] White (1925): 'Life and Correspondence of Willard Fiske.'

extensively. There is also in winter a school attended by children between the ages of ten and fourteen. The task of schoolmaster is shared by a resident of Akureyri, who spends each winter on Grímsey, and the pastor, Matthias Eggertsson.

It is said that in the nineteenth century the population reached 120; but this figure has never been exceeded since. By 1855 it had fallen to 46, since when it has been slowly increasing until in 1932 the population was 120 again. In 1933 it was 115 (67 males and 48 females). Grímsey would appear to be unique amongst remote islands in one very important aspect. There is not at the present time on the island a single farmer whose father lived there before him.[1] Matthias Eggertsson, who has been the pastor of the island for forty years, has been there longer than any of the other inhabitants—he has in fact seen a completely new population come to the island. This process has apparently been going on for a great many years, and no doubt largely explains the progressive and enterprising state of the community, a state unusual on such a small and inaccessible island. Of the fourteen farms on the island only three are the property of the farmer living there. The others are rented from the state for the lifetime of the lessee, and on his death are taken, probably not by his son but by a farmer from the mainland. The present inhabitants have come from all parts of Iceland, and we were told that there were always farmers anxious to rent a farm on Grímsey as soon as one should become vacant. The government installed a wireless receiving and transmitting apparatus on the island six years ago. By this means weather reports are now transmitted three times each day to Húsavik, with which there is two-way communication; the station also transmits to Akureyri. There is no telegraph cable to the mainland.

The most important occupation of the islanders is fishing. This is carried on within 2 or 3 miles of the island in small open boats. There were in 1934 seven motor boats and two rowing boats. The catch is sent to Akureyri and Siglufjörður; and in 1933 $52\frac{1}{2}$ tons of cod, $34\frac{3}{4}$ tons of codling, 2 tons of coalfish, and 1 ton of halibut were exported.[2] The fishing round Grímsey is better than that round the coasts of north Iceland, and people spend certain seasons of the year there for this reason. Agriculture, which is of secondary importance to fishing, resembles that practised on the mainland, except that it is if anything more haphazard, and consists almost entirely of the production of hay on which to feed the cattle during the winter. The tún (cultivated pasture) extends down the west side of the island. The old turf wall which formerly bounded it is now broken down, and a barbed-wire fence erected some 30 or 40 yards farther east, but the land between it and the turf wall is as yet in its rough primitive condition. In process of time the old tún itself always becomes hummocky and coarse [3] and requires levelling. The course adopted varies according to convenience. Gradually the turf is peeled from the hummocks for use in building, etc. The hollows are filled up with rubbish

[1] This is the more remarkable when it is realized that on the mainland it is usual for a farm to be passed from father to son for many generations.

[2] Figures by permission of Þorsteinn Þorsteinsson.

[3] Due to frost heaving. See L. Hawkes: "Frost Action in Superficial Deposits." *Geol. Mag.*, vol. 61 (1924), p. 509.

of any sort, including fish offal and bones. The hummocks are broken up with a spade or by a machine fitted with revolving blades, and the whole is then ploughed. Sometimes it is then left entirely to itself to regenerate a grassy covering, while sometimes slabs of turf are laid down. In this latter case however no attempt seems to be made to plant them close together or to press them down, with the result that the turves are liable to dry up completely and die, preventing any colonization which would have taken place if left alone. Cow and sheep dung is also spread over the pasture occasionally. There are a few small plots where potatoes are grown; as on the mainland a slope with a southern aspect is always chosen. The potatoes are planted in June and gathered in October. A little rhubarb is also grown, but except perhaps for one plant of valerian and another of monkshood in the churchyard, these are the only cultivated plants. The islanders keep about 20 cows and between 250 and 300 sheep, the latter both for their flesh and wool. Though in the past woollen cloth was prepared on the island, the fleeces are now sent to Akureyri. Each farm has a few domestic hens, which seemed to exist to a large extent on the fish offal which is used for manure. There are also 3 ponies.

The islanders derive a considerable revenue from the birds nesting in vast colonies on the cliffs. Eggs are collected in the first three weeks of June, and in autumn the birds are taken in large numbers. In 1931 (the last year for which complete figures are obtainable) 790 Guillemots, 2620 Fulmar Petrels, 8200 Puffins, and 9950 Kittiwakes were taken.[1] In a normal year about 12,000 eggs are collected, but in 1934 the first layings of the birds were largely destroyed by an earthquake on June 2, whose epicentre was in the neighbourhood of Dalvík in Eyjafjörður, some 35 miles away. Although the shock did no damage to any of the houses on the island it was sufficient to dislodge stones and small boulders from the cliffs which destroyed many thousands of eggs. As the second layings of the birds are never taken only some six hundred eggs were this year exported. The collection of these eggs is the work of six or eight men, who are paid 1 krónur an hour by the owner of the portion of the cliff from which they are collecting. Earthquakes have been experienced twice previously on the island, in 1755 and 1838; and on both occasions large falls of cliff took place. About 25 lb. of eider down are collected annually. The eider duck nests commonly all over the southern part of the island, and the down is removed from the nest when the young have left. The adult birds are not, as in some places on the north coast of the mainland, killed for food.

Note on the Zoology. By P. F. Holmes

A general collection of the terrestrial and freshwater fauna of the island was made for comparison with that of the mainland. The most notable absentees from Grímsey were gasteropod molluscs and bumble bees, and the number of moths was comparatively small. There is also a complete absence of small mammals. On the other hand a species of spider and a species of sawfly were found which have not previously been recorded from Iceland. The presence of certain animals on the island suggests that Grímsey was separated from the mainland after the last glacial period. Such animals as earthworms, planarians,

[1] Figures by permission of Þorsteinn Þorsteinsson.

bivalve molluscs, and large ground beetles are present, and all these would find it impossible to cross a stretch of sea, whereas the remainder of the fauna could probably have reached the island by flying, by being blown across, or through the agency of birds.

Note on the Botany. By E. W. Jones

The most striking feature of the vegetation of Grímsey is the complete absence of all dwarf shrubs and woody plants such as *Betula nana* and *Vaccinium uliginosum*, which cover large areas of the mainland. This may be partly due to the lack of snow cover, but cannot be entirely due to this, since some of the absentees —*e.g. Dryas octopetala*—are characteristic of areas where snow cover is poor. The greater part of the island is covered with rough grassland in which *Poa alpina*, *Juncus trifidus*, and *Carex rigida* are abundant. Owing to the lack of permanent marshes or streams and the absence of sheltered inland cliffs the flora is poor in species. Nevertheless it seems to contain a definite alpine element of plants which on the mainland have their headquarters at higher altitudes.

Note on the Ornithology. By D. B. Keith and P. F. Holmes

The birds of Grímsey are those which might be found frequenting any similar coastal area on the mainland of Iceland; but the island is remarkable both for its very high density of bird population, and for the large numbers of non-breeding birds found there every summer. The Arctic Tern breeds in exceptionally large numbers, and the other species particularly numerous are Golden Plover, Dunlin, Purple Sandpiper, Red-necked Phalarope, Meadow Pipit, and the Guillemots, Kittiwakes, and Fulmars, which breed in vast colonies on the cliffs. Periodic non-breeding is normal amongst certain Arctic species, but the birds thus found on Grímsey are those usually unaffected. Large numbers of non-breeding Golden Plover, Dunlin, Kittiwake, Purple Sandpiper, and Great Black-backed Gull frequented the island, though all except the last two species were also breeding in considerable numbers.

Note on the Survey. By D. B. Keith and W. R. Holman

The map was constructed by plane-table on a scale of 1 : 20,000. A cairn had been erected on the island by the Danish Geodetic Institute, and its position and height were known. Spot heights were fixed by the Indian Clinometer, and the contours filled in from these. As the sea horizon was visible from every part of the island the drawing of the contours was simplified; for the plane-tabler, when occupying a station on a contour, could assume that all points which appeared from there to coincide with the horizon lay on the same contour. The errors involved in this process were negligible as the heights and distances in all cases were small. These further points were then fixed by resection.

NAUTICAL TIME AND CIVIL DATE

A LETTER to the Secretary, Royal Geographical Society, from Mr. Thomas F. Milne, of Caulfield, Victoria, Australia, raised a number of interesting questions. He wrote:

"I should esteem it a great favour if you can furnish me with any information as to the precise time when navigators abandoned the old practice of making no adjustment to their ship's time (*i.e.* date) at the 180th meridian, and only did so when they entered the first civilized port. I suppose that old practice was discontinued at the instigation of some authoritative body, but nobody here seems able to give me any enlightenment on the subject. You will, of course, be aware that the old method was followed by Cook, but in recent days certain pedagogic oracles here in Australia have developed a mischievous propensity, as I regard it, of bringing the great navigator's ship time 'up to date.'

"That is to say, they bring his ship time, as it relates to his passage along Australia's eastern seaboard, into accord with calendar time as now observed in our eastern States—10 hours ahead of Greenwich. In my opinion such a 'correction' of the logs of Cook, or any of the old maritime explorers, is pedantic and altogether unwarranted. If it is fitting to say—as an official publication, the Commonwealth Year Book, does say—that Cook, who was sailing 'West about,' made his Australian landfall at 6 a.m. on April 20th, 1770, the time shown on his log and journal being 6 a.m. of April 19th, it follows that it would be just as proper to deal in similar fashion with Cook's New Zealand dates, and the dates relating to quite a number of places he visited in course of his three voyages which only set up a civil calendar long after his day. For example, on his third voyage he was sailing *East*, and his ships were in 204 degrees East longitude at the spot where his career came to a tragic close.

"By his ship's time he was killed in the A.M. of February 14th, 1779, and that date is still universally accepted as the correct date of his death. But the longitudinal position of the two ships made them 13 hrs. 30 minutes *ahead* of Greenwich, whereas the Hawaian Islands are now reckoned to be 10 hrs. 30 minutes *behind* Greenwich. Are we therefore to say that the date of Cook's death, as we find it recorded in many books, and on many monuments, is incorrect to the extent of 24 hours; and that February 13th, not the 14th, is the true date of the tragedy?

"In short, endless confusion would inevitably ensue if the habit of tampering with Cook's logs which is growing up in Australia were to become general. . . . Meanwhile, I should be very glad of any information you are in a position to give me as to when the globe was divided, for navigational purposes, into east and west longitudes at the 180th meridian, and at whose instigation the change from the old practice was brought about."

It will be convenient to distinguish the several questions by numbers. They are in effect:

I. When did circumnavigators abandon the old practice of reckoning their longitudes continuously from 0° to 360° east or west as might be?

II. And when did they adopt the present practice of changing the date on crossing the 180th meridian?

These two questions are evidently closely related, but the answer is not necessarily the same.

III. Is it permissible to change the dates entered in ships' logs, to conform with modern conventions?

In response to a request from Vice-Admiral Sir Percy Douglas, to whom Mr. Milne's letter had been referred, the Librarian of the Admiralty (Mr. D. B. Smith) very kindly went into the matter, so far as related to the practice in Cook's day, and gave us the following references to I:

> Byron, on his arrival at Batavia in November 1765, says: "The next day, which by our account was the 28th, but by the account of the Dutch at this place was the 29th, we having lost a day by having steered westward a year . . ."
>
> Wallis, after leaving the Cape of Good Hope for home, in February 1768, says: "On the 13th, having sailed westward 360 degrees from the meridian of London, we had lost a day; I therefore called the latter part of this day Monday, March 14th."
>
> Krusenstern, in his 'Voyage round the World,' says: "On the 29th April (1806) we had made three hundred and sixty degrees of the Greenwich meridian from east to west. I therefore altered my reckoning; and as we had lost a day, called the next the 1st of May."

At least up to 1806, apparently, the practice was to carry on at sea until a whole day had been gained or lost, and then to make the change. While a ship was in port she might find her reckoning different from the port reckoning, but she did not alter it except perhaps temporarily. When was the practice changed? We have not up to this point found any reply to this question II.

As to I, Mr. Smith refers us to the International Meridian Conference, Washington, 1884, when the following resolution was adopted:

> "That from this meridian (*id est* Greenwich) longitude shall be counted in two directions up to 180 degrees, east longitude being plus and west longitude minus."

But this merely confirmed what was already used extensively. At the request of Sir Percy Douglas, the Hydrographer of the Navy caused a search in the early charts of his departmental collection, and has kindly supplied a list of examples which may be summarized thus:

A. Division continuously East or West from Prime Meridian

1747	MS. Spanish Charts	275° to 320° E. of Ferro
1770	Cook's first voyage: East coast of Australia and New Zealand . .	205° to 210° W. of Greenwich
1778	North America: H. Hanwell . .	65° to 204° W. of Greenwich
1790	World Chart: Arrowsmith	0° to 360° E. of Greenwich
1791	Track of *Pandora*	105° to 240° W. of Greenwich

B. Division East and West of Prime Meridian

1765	Commodore Byron's track	83° W. to 169° E. of Greenwich
1772–5	Cook's second voyage: Gilbert's charts	0° to 180° E. and W. of Greenwich
1773	Hydrographie françoise	0° to 180° E. and W. of Paris
1789	Atlas maritimo: Tofino	E. and W. of Cadiz
1790	Pacific Ocean: Arrowsmith	to 180° E. and W. of Greenwich
1791	Track of *Albemarle* and *Gorgon* . .	to 180° E. and W. of Greenwich
1805	World: Laurie and Whittle	0° to 180° E. and W. of Greenwich
1807	Track of *Cornwallis*	65° W. to 160° E. of Greenwich
1851	Track of *Comet*	130° W. to 147° E. of Greenwich

There is thus no evidence of any clearly defined change in the reckoning of longitude: the custom altered gradually between 1750 and 1800, and the older method survived into the nineteenth century. Two track-charts of Captain Colnett's voyage round the world, published in 1802–03, are graduated respectively from 30° W. to 195° W., and from 30° W. to 168° E.; while a World Magnetic Chart by T. Yeates is graduated to 360° E. at the top and to 180° E. and W. at the bottom.

For the history of the Prime Meridian we may refer to the article by Mr. W. G. Perrin in *The Mariner's Mirror* for April 1927. The earliest maps on which he was able to find the Greenwich meridian as the origin of longitudes were two charts attached to the 'Description of the Sea Coast,' by Fearon and Eyes in 1738, and the 'Survey of the County of Oxford,' by Thos. Jeffreys, published in 1769. The meridian of Greenwich was used in the magnificent collection of charts, the 'Atlantic Neptune,' published from 1777 onwards: and thereafter it soon superseded all others in English maps and charts.

Before dealing with question III we must refer to a complication which is fundamental, though it does not appear in Mr. Milne's letter. Mr. Smith writes:

> So far as I know, the only thing historians in this country do is to alter nautical time to civil time. Till 1805 logs were kept in nautical time; that is to say when they were written up at mid-day, that day's entry consisted of the proceedings for P.M. of the day before and A.M. of that day.[1] The change was ordered by Admiralty Circular of 11th October 1805 which ordered that "the calendar or civil day is to be made use of, beginning at midnight." The orders reached the Mediterranean Fleet too late for Trafalgar, so that the Trafalgar logs are in the old form; and the Admiralty Trafalgar Committee (1913) put this explanation in their Report: "In 1805 the Nautical day commenced at noon, twelve hours earlier than the civil day. The proceedings given in the Logs as for 20th October are really the proceedings for the afternoon of the 19th, followed by those for the morning of the 20th, civil time. . . . Similarly, the details of the Battle are shown in the Logs under "22nd October P.M." The Private Diary of Lord Nelson was kept in civil time.
>
> We find Cook's journals kept the same way, and in editing the journal for the first voyage Admiral Wharton reproduced Cook's own "Explanation" (from Journal) which begins "It is necessary to premise by way of explanation, that in this Journal (except while we lay at St. George's Island) the day is supposed to begin and end at noon, as for instance, Friday the 27th May,

[1] The standard text-book on navigation in Cook's day was J. Robertson's 'Elements of Navigation.' The following quotation is from the 4th edition (1780), revised by William Wales, II, 315–6: "The Log-Book is a book ruled like the log-board, in order to contain the daily copies of the remarks written on the log-board, which is the only authentic record of the ship's transactions; and these are by the persons who keep Journals transcribed every day at noon into their log-books, from which they make the necessary deductions relative to the ship's place . . .

". . . Mariners reckon time in the astronomical manner, beginning at noon and counting from thence 24 hours to the next noon. The first 12 hours, from noon to mid-night, they mark with P.M., signifying after mid-day; and the second 12 hours, from mid-night to noon, they mark with A.M., signifying after mid-night; and end their day's work on the noon of the nominal day. Hence their ship account is 12 hours earlier than the civil account of time. . . . Thus that day's account which is marked Sunday the 9th of October, began on Saturday noon, and ends on Sunday noon."

began at noon on Thursday 26th and ended the following noon according to the natural day . . ."

The official narrative, got out under Admiralty order, of Cook's last voyage narrates the circumstances of Cook's death under Sunday, February 14th, 1779. Captain King says that Cook left for the shore "between seven and eight o'clock;" he means A.M., so that the incident should be recorded in the Ships' Logs for the 14th when made up at mid-day on the 14th, and this is so. Lieutenant-Commander Gould published in *The Mariner's Mirror* (the journal of the Society for Nautical Research) for October 1928, transcripts from these logs and journals in 'Some Unpublished Accounts of Cook's death.' The *Discovery's* log for Sunday 14th first gives P.M. events (that is, what happened between mid-day on the 13th and midnight), then A.M. events (including the report at 9 A.M. of Cook's death). It is the same with the other logs and journals he reproduces.

There were thus in use in the Navy until 1805 three days: the nautical, the civil or natural, and the astronomical. The nautical day entered in the log as May 10 began at noon of May 9 of the civil reckoning, and P.M. thus came before A.M. On the other hand, the astronomical day of May 10 began at noon of May 10 by civil reckoning, and ran from 0^h to 24^h ending at noon on May 11. This was the time used in the *Nautical Almanac*, first published in 1767, and this was the time kept by Mr. Charles Green, the astronomer on Cook's first voyage. Though it must have been in continual use in the navigation of the ship, it does not appear in the logs. But it must be borne in mind as a possible source of confusion.

The log was kept in ship's time, that is, the local apparent time, adjusted at intervals to the change of longitude: and by old practice an adjustment was made at noon, when the officer taking the latitude sight called "Twelve o'clock, Sir," and the Captain said "Make it so," (though the actual observations for local time were necessarily made morning and afternoon). If it were necessary to establish the accurate time of an event we should have to enquire more particularly whether the time of the nautical day was on that ship carried on from the noon on which it began, or adjusted to the noon on which it ended, or perhaps altered during the night from one to the other, as is more or less the present practice in merchant ships, though H.M. Navy keeps Standard Time. In default of better information we may without serious error (in days of sail) take the recorded hour as in the apparent time of the meridian of longitude mentioned in the account, and for form's sake apply the equation of time to reduce to civil time of the meridian.

If any one should require to go beyond the day and hour of the log, the only safe procedure is to reduce to Greenwich Civil Time: after which we can if we like argue securely about what would have been the date if the voyage had been made the other way round, or if the present rules for change of date had been followed then. The process is best studied in examples. Let us discuss the dates of Cook's landfall on the south-east Coast of Australia, his landing at Botany Bay, and his death in Hawaii.

Cook's Landfall, 1770

On his first voyage Cook sailed west, and kept his longitude west of Greenwich. The land he estimated as in long. 211° 7′ W., or $14^h\ 4^1/_2{}^m$, say 14^h. We have then for the date of landfall:

Journal Thursday 19 April 6 a.m. = Ship's Apparent Time April 19, 6^h.
Adding the long. W. this is Greenwich Civil Time April 19, 20^h.

The Equation of Time is on this date less than a minute, and is here neglected.

Cook's Landing at Botany Bay

Journal Sunday 29 April p.m. = Ship's Apparent Time say April 28, 15^h.
= Greenwich Civil Time April 29, 5^h.

If in 1770 Cook had been keeping the time which is now Standard in New South Wales, 10 hours fast on Greenwich, he would thus have made his landfall on Friday, April 20, at 6^h, and his landing at Botany Bay on Sunday, April 29, at 15^h, and these dates, April 20 and April 29, are adopted in the Official Year Book of the Commonwealth of Australia. Number 22 for 1929, p. 3, says that Cook sighted the Australian mainland on April 20 at 6 a.m., discovered Botany Bay on April 29, and landed on the following day. Number 25 for 1932 corrects this, and says the arrival and landing took place on the same day, *i.e.* 29 April, 1770. The Australian Encyclopaedia, vol. I, p. 432, says: "At daybreak on 20th April, 1770, he sighted land. . . . At 2 p.m. on Sunday, 29th April, the *Endeavour* anchored in Botany Bay. At 3 p.m. Cook landed." This is what our correspondent calls "the mischievous propensity of bringing the great navigator's ship time up to date."

Cook's death

On his third voyage Cook was sailing East about and the longitude of the place in Hawaii where he met his death is about $204° = 13^h\ 36^m$ East of Greenwich. He went ashore on "Sunday, February 14 between 7 and 8 o'clock." Supposing that he was killed at 8 o'clock by this reckoning we have:

Journal Sunday 14 Feb. 1779, 8^h = Ship's Apparent Time Feb. 14, 8^h
Applying the Equation of Time, 14^m, this is Local Civil Time Feb. 14, $8^h\ 14^m$
Subtracting the Long. East $13^h\ 36^m$, this is Greenwich Civil Time Feb. 13, $18^h\ 38^m$
or in the present Hawaii Civil Time ($10^h\ 30^m$ slow on Gr.) Feb. 13, $8^h\ 8^m$

That is to say whereas the narrative says that he was killed on a Sunday morning, it was only Saturday evening at Greenwich, and would have been Saturday morning in the narrative if Cook had been sailing West about instead of East about.

The important point seems to be that in the reckoning of the whole voyage he was killed on a Sunday: and that if the historian tampers with the dates of the principal events in a voyage, he throws them out of relation to the remainder of the narrative. We are therefore disposed to agree with our correspondent, that it is mischievous to bring historic events "up to date" in time reckoning.

A. R. H.

THE GORGE OF THE QAL'A CHOLĀN AND ITS CONFLUENCE WITH THE LESSER ZAB: NOTES OF A TOUR IN SOUTH KURDISTAN IN 1921

FRANCIS M. HALLEY, M.B., CH.B., formerly Civil Surgeon at Sulaimani

In the Journal *for February* 1922 (*vol.* 59, *p.* 146) *we published a note on a "Correction to the Tigris Corps Map in the Lesser Zab Region," based on a letter from Mr. C. C. Garbett, of the Iraq Secretariat, giving an extract from the report of an unnamed Civil Surgeon at Sulaimani, dated* 29 *October* 1921, *which read*

"*In particular the true course of the Qaracholan River was determined, for while by 'T.C.*230 *the course runs to a confluence with the Zab in square A.A.*4(*B*), *it actually runs due north and the confluence is in square A.A.*7(*A*) *about* 50 *miles further up the course of the Zab. It breaks through the mountainous country of Mawat by immense gorges.*' "

No map accompanied Mr. Garbett's letter, and it was not until a few months ago that an inquiry for the map, which it was supposed we had received, led to correspondence which revealed the name of its author, now in India, and allowed us to ask him for an account of his exploration, which we now have the pleasure to publish.

The extensive area covered by Mr. Halley's sketch-map has now been surveyed on a ½*-inch scale, and the maps published by the Survey Department of Iraq necessarily supersede a sketch-map which at the time it was made was invaluable. We are reproducing from a photostat copy of the original the piece which shows Mr. Halley's major discovery of the 'Qaracholan' (or properly Qal'a Cholān) Gorge. The spelling of the names in Mr. Halley's paper has been assimilated to the maps of the Survey of Iraq. The spelling differs a good deal from that used upon the earlier degree sheets of the Survey of India. Those names used by Mr. Halley which do not appear upon the Iraq map have been printed in italic, since it is probable that in some cases they represent a phonetic rendering of the local pronunciation rather than a transliteration from the written word.*—ED. *G.J.*

THESE notes concern a tour made by the writer while Civil Surgeon of the Sulaimani or South Kurdistan Division of the then Mandated Territory of Iraq in 1921. The Division, at the period of which I write, extended from the crests of the mountains south of Rowanduz, the *Gurmanjan Gedik–Nuchewan* ranges in the north, to the Shirvan river in the south, and from the Persian frontier in the east to west of the village of Chemchemal. The headquarters of the Political Officer was at Sulaimani. The area included in this tour was chiefly along the eastern boundary where the ranges of Zagros formed, as they ever have, not only a geographical but also a political line of demarcation, whether it were between Assyria and Media or between the territories of the Shah and those of the Sultan, and now of Iraq.

Zagros, Choathras, Zara, Zaraspe, by which varied names the mountain chain dividing the Iranian plateau from the Tigro-Euphratean plains was known in ancient times, has to-day no collective appellation. From *Argot Dagh* and *Kandil Dagh* in the north to the Avraman Dagh and onwards to the Tak-i-Girreh pass in the south the range receives purely local names derivable

from the neighbouring villages or from the particular prominence of some conspicuous peak. The mountain ranges run practically invariably north-west to south-east and the valleys normally correspond.

The maps available at the time, which were those used by the army in the Mesopotamian campaign, were of varied accuracy. The boundary between Persia and Iraq had been clearly indicated by the Frontier Commission of 1913 and the areas concerned in possible military operations had equally received attention from Turkish and British cartographers. Between these there lay extensive lacunae in which the positions of villages and natural features had been laid down from local information and from the narratives of travellers who had passed through the country, but whose various accounts were uncorrelated and partial. Varying names of mountain, river, pass, or valley, disappearance of some villages and the appearance of new ones rendered accurate map-making difficult; the non-commercial value and unsettled states of the district did not encourage surveys apart from the military areas, and thus our maps contained both recent information and also that dating back to the times of Chesney, Ainsworth, Layard, Rich, Lynch, and other early nineteenth-century voyagers.

The tour described in this account was made to investigate the incidence of malaria in the hill villages as compared with those in the plains.

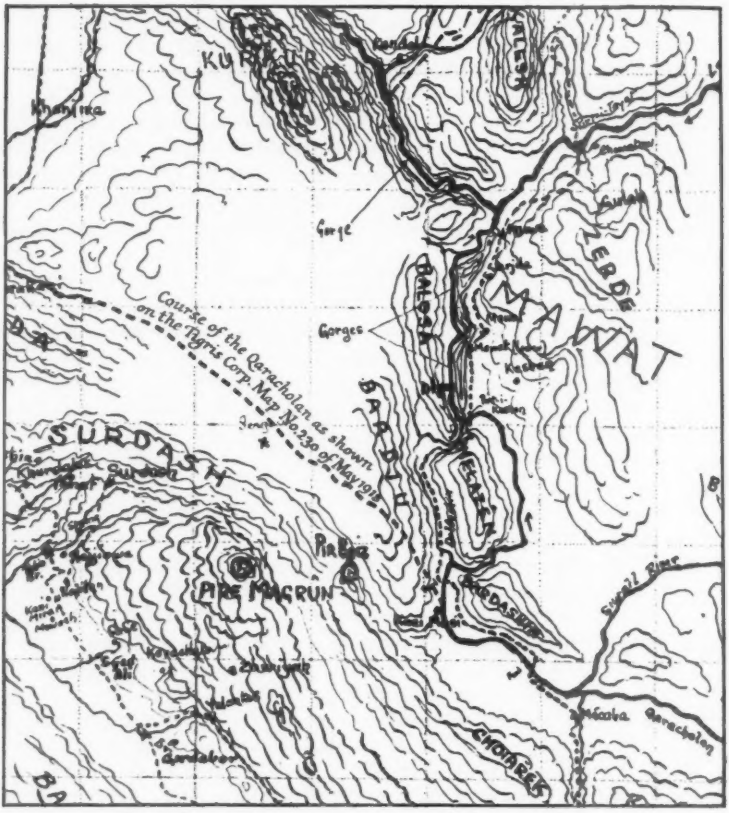
Starting by horse from Sulaimani I rode on a reasonable motor road for about 45 miles over undulating country to Dukan on the Lesser Zab. The track on starting lay up the Tanjaru valley; about half-way the isolated peak of Pir-i-Mugurun (*c.* 10,000 feet) was seen above the moderately elevated range which lay continuously to the east. Across the Tabin river the valley of Surdash opened out to the northwards and the road wound in and out among groves of oak and walnut.

To the east the perpendicular and precipitous cliffs of the Surdash mountains continued the chain, and here the semi-circular enceinte of the walls and projecting bastions of the Baban period overhung the small and squalid village from which the mountains took their name (Surdash). Ultimately a steep descent led to the vale of the Lesser Zab, opening up towards the north-east, where the prospect was closed by the cliffs of the Shaikh Ismail pass.

Northwards and westwards across the river rose wooded hills above which the bare summit of the Kotsrut Dagh (6000 feet) was very prominent. Also, on the north bank of the Zab was a ruined fort on a bluff, Qalat Dukan, a relic of the suzerainty of the Begs of Rowanduz (early nineteenth century).

It is not unreasonable to suppose that along this line lay the ancient Persian Royal Road from Susa to Sardis, in that part of its course between Erbil (Arbela) and the passes of Zagros (east of Qasr-i-Shirin). It seems to afford the only easy and natural track in the district; and the ruins of ancient bridges and the occurrence of numerous mounds indicate an ancient line of communication. The course might have been from Erbil *via* Köi Sanjaq, crossing the Zab near Dukan, and so by the Sulaimani valley to the Sharizdur plain in the south (the ancient Siazauros, a former centre of Sassanian fire worship with many ancient mounds and tumuli), thence *via* the Shirvan river and the headwaters of the Diyala to the Tak-i-Girreh pass, the Portae Zagricae near *Holwan*.

At Dukan, a village of about ten or twelve houses on the left bank, the Zab is crossed by kellek (raft on inflated skins) in flood time, or forded in low water. It was a dirty, vermin-infested place which I always avoided when on tour, preferring to cross the river and sleep in the clean and hospitable quarters of the Keokhah (head man) Mustafa in Gulnesi village. The crossing was by no means difficult, the water being only a couple of feet deep, and indeed I have seen a squadron of Kurdish levy cavalry cross without a stirrup



Reproduction of a section of the author's original map

wet. But towards the right bank pot-holes scoured out by floods required a little caution, and a wet-foot guide was advisable.

An hour's ride across the awkward shaly slopes of the Hab es-Sultan Dagh led to the remote and quiet village of Gulnesi, in a deep cultivated valley with orchards and vegetable gardens, and with a small stream flowing by. The descent to the Gunlesi valley was over crumbling shale, difficult enough even by day, and worse after dark. On one former occasion, arriving late, one of

my baggage mules laden with medical stores had skidded on the insecure foothold and disappeared out of sight into the gloom below. The muleteer, hanging on to the halter, went with it. Awful sounds ascended from the dark abyss, and I foresaw the loss of much quinine, Epsom salts, and purgative pills. But on my arrival at the village level I found mule and muleteer complete with medical panniers, the only damage being impressive abrasions of the mule's rump. That mule must have slithered down some 200 feet, and yet managed to maintain its balance.

On the following morning I rode on up the valley towards the southern shoulder of Kotsrut, which separated me from the *Rania* plain, and at the summit, after about two hours' climb, a magnificent view opened up to the east and north. Below me lay the great level intersected by the winding stream of the Zab, between the plain of Bitwain (or *Rania*) to the north and that of Merga to the south. Beyond to the east was the gorge of the *Derbend-i-Rania*, the line of the Asos Dagh ending to the southwards in the mass of the *Kurkut Dagh*, and yet farther away eastwards the huge ranges of *Kandil Dagh* (10,000 feet) and the mountains of the Persian frontier. Descending steeply, I reached the plain by a valley which led to the Zab at the village of Mirza Rustam, where there is a kellek ferry and a ford. This village had a local reputation for vermin, mosquitoes, and bed bugs which I can confirm.

On the Society's Map of Turkey in Asia, Syria and West Persia, corrected to 1917, the Qal'a Cholān river, with whose course this paper is mainly concerned, was indicated by a dotted line across the Merga Plain, entering the Zab just about opposite Mirza Rustam village immediately above the Shaikh Ismail pass, and flowing apparently from behind the Surdash mountains. No river of appropriate size was visible, and this was confirmed later by riding over the area. I continued on the right bank of the Zab however, across a monotonous grassy plain, crossed the wide shallow bed of the Basalam river, passed the villages of Qurah Shinah and Baz Musiyān, and by evening reached the residence of the Assistant Political Officer, a newly built bungalow some 200 yards short of the *Rania* pass. The Assistant Political Officer lived a very lonely existence here, being 90 miles from headquarters in Sulaimani. His quarters consisted only of his house, an office lower down the hill, the residence of the necessary officials, and a small post of levies.

He sometimes organized wild-pig hunts with local tribesmen. The pig were chased out of the tamarinds along the *Basalam* river and were ridden down and shot from the saddle. Very excellent runs were obtained over the grassy rolling country. The Kurdish members of the field were quick but not very accurate shots.

The *Derbend* gorge is narrow and difficult to traverse, though fortunately only 150 yards long, between the razor-backed ranges of the Asos Dagh. A little to the west of the pass there are the remains of an ancient fortification, though of what period has not been determined. They are of rude construction. From the summits of the hills above the pass magnificent views are obtainable, both eastwards and westwards over the plains of Puzhdar and *Rania* respectively. The plain of *Rania* abounds in tobacco, but has a very bad reputation for malaria. During my stay here I rode up to Rabia village, some 7 miles north of *Derbend*. The village, situated at the foot of a mound,

is squalid and uninteresting, and very malarial. To the northwards the wooded valleys of the Shawr district ascend towards the precipices of the Garu Manjal, which formed the boundary towards the Rowanduz area then in the occupation of the Turk or pro-Turkish tribes; a dangerous winding track of about 6000 feet led through to the Rowanduz valleys. The villages in the Shawr valleys which I had visited in 1921 were beautifully situated among woodlands and orchards, terraced slopes of tobacco and cultivation. Shawr tobacco had very high local reputation, being naturally scented.

We (the A.P.O. and myself) proceeded eastwards next day to visit Babekr Aga, Chief of the Puzhdar Kurds of Qal'a Diza, in the Puzhdar plain east of the *Derbend-i-Rania*. In the jaws of the pass through which the Zab flows is a small partially ruined stone fort. Traversing the pass, we rode through the plain for about one and a half hours and reached Qal'a Diza, a small village at the foot of a mound. Babekr Aga was remarkable for his good sense and loyalty to Government, qualities somewhat rare among the Kurd. He keeps his left eye permanently covered and no one knows what disease or injury has affected it, though I have heard it rumoured that in his youth he burst a blood-vessel in his eye by lifting heavy weights for a wager.

Bounding the Puzhdar plain to the east are the mountains of the frontier, with the Wazna pass leading through into Persia.

Both the Wazna and the *Kelishin* in the Rowanduz district have been suggested as routes by which the Byzantine Emperor Heraclius may have moved from lake Urmia to the battle of Nineveh in his third campaign against the Persians (A.D. 626–37). Either is possible, but the *Kelishin* route and the valleys of the Greater Zab are the more direct and suit with the contemporary narratives. Thus, *via* the *Kelishin* pass, Rowanduz (Orava), Eski Kellek (or Girdammak) fords or ferries, to Nineveh. I have ridden this route and it should be readily passable for an army accustomed to rough warfare as Heraclius's was.

Leaving Qal'a Diza, a pretty ride through wooded country past Dashtew village, the place of origin of the Begzada (tribal aristocracy) of the Puzhdar, with their family tombs, led after a long and tiring day across the Persian frontier to Garamāwa, the village of 'Abbas-i-Selim Aga, the brother of Babekr. It may be here remarked that the Puzhdar tribe have extensive connections on both sides of the frontier and part are permanently domiciled in Persia, while during the summer months many seek the Persian hills, which they call going to their Kuhistan or cool quarters. To the west of our route, which lay through the valleys, rose the dark precipices of Asos and *Kurgur Dagh* (6000 feet) beyond the deep gorges of the Zab. In one of these valleys where we drank some tea at a chaikhanan (wayside teashop) a dog fight was provided for our delectation between two famous rival sheepdogs of the neighbourhood. The dogs were huge, savage, long-haired animals, but although they fought well and bravely, the show was not by any means attractive to a lover of dogs, though it is a favourite amusement among the Kurds and peculiarly suited to their taste.

Before arriving at Garamāwa we were met by 'Abbas Aga with a considerable troop of horsemen and escorted over very difficult country to his village, which lay in a richly cultivated valley recessed into the *Zerdka Dagh* (4700 feet) to the east, which here forms the Persian frontier.

The residence of 'Abbas was that of a country aristocrat, more tinged with the manners of Persia and with its refinements than that of an ordinary Kurdish chief. We sat upon Austrian bent-wood chairs and dined with knives and forks on a most delectable pilaf, while admiring on the walls the oleographs representing scenes from the Russo-Turkish War and the portraits of the Sultan, our late Sovereign King Edward VII, and his Royal descendants.

Behind the village the terraced vineyards rose up towards the bare peaks of the hills. We slept peacefully in the cool courtyard near a fountain and undisturbed by mosquitoes under the shade of ancient trees. 'Abbas Aga, though holding lands in the South Kurdistan division, was tributary to the Persian Government, for by far the greater extent of his possessions lay in Persia and his residence Garamāwa was practically plumb on the boundary, although he asserted that it was definitely in Persia.

The following day, accompanied by 'Abbas, I rode southwards over the slopes of a beautifully wooded hill, *Talesh Dagh*, and descended steeply to the upper waters of the Lesser Zab, which here flowed in a deep valley between forested mountains. To the west the Zab then turned sharply northwards through immense gorges along the eastern base of the lofty mass of the *Kurgur Dagh*, which was the dominating feature of the landscape. Reaching the river, I found that 'Abbas Aga was rebuilding the *Pirt-i-tyet* or Tyet Bridge. The structure consisted of huge rough stone piers over which a roadway of trunks of trees and interlaced brushwood was laid. I understood that he was undertaking this work as task of atonement for some (to me) unknown sin. Here I left 'Abbas, the Zab being frontier, and rode southwards along the wooded mountain slopes of the Mawat district, high up above the river. Beneath and below the village of Isa-awa could clearly be seen the confluence of the Qal'a Cholān with the Zab, which had not previously been determined. The Qal'a Cholān river flowed in very definitely from the south and joined the Zab at its northwards bend. It was not at the moment recognized as being such, but the casual remark of one of my police escort indicated that he knew that it was so, and therefore I directed my attention very definitely to the problem.

Continuing my ride over forested hills we reached Mawat by evening, where we stayed with the Mudir for the night. His headquarters were so typical of the mountain communities that I may briefly describe their particular amenities. The hill villages are usually built on the slopes of the hill, the houses often rising in stages one above another, while vineyards clothe the hills above them, and gardens, orchards, and tobacco the valleys below. These villages are generally richer, cleaner, and much more beautiful than those in the plains, and usually possess a very fine water supply from springs gushing out of the hills. The villages in the plains are as a rule poor, dirty, squalid settlements, often with a poor water supply and but scanty cultivation.

The ordinary type of Kurdish house is of stone cemented with mud, one-storeyed, with low rooms roofed with great smoke-darkened beams covered with earth. The windows are merely small rude holes in the walls and the floors are usually of earth with an open hearth in centre. In the larger hill villages, especially towards the Persian frontier, houses of much greater pretensions can be seen with windows and verandahs, but these are usually the

residences of the sheikhs and agas, and the majority of the poorer houses correspond to the type mentioned above.

Of the sanitary arrangements of the plain villages the less said the better—they are often built on dungheaps and plastered, roofed and buttressed with the same material. In the hill villages the presence of good water supply renders sanitation much easier, and in some places actual sanitary conveniences with a water channel beneath are to be found, though this is exceptional.

Leaving Mawat I made a detour to the westwards, ascending some particularly uncomfortable ridges by a pretty steep aclivity until I gazed down into an unexpected gorge. The ground fell away in a sheer descent of say 2000 or more feet, and in the darkened depths could quite clearly be seen the stream, and by looking to the right its course to its confluence with the Zab could be distinguished, while southwards its channel was clearly visible in moderately hilly country wherein it could readily be followed. This was the Qal'a Cholān. Perched in precarious sites on the verges of the gorges were several small villages unattainable from my direction and concerning which my muleteers held some superstitious fears.

Instead of flowing into the Lesser Zab about 36′ N. 45′ E., as represented in the maps up to 1922, the Qal'a Cholān actually joins it some 35 miles eastwards as the crow flies, or, if one follows the course of the Zab, some 60 miles farther upstream. The gorges of the Qal'a Cholān through the Mawat range are entirely impassable at the water-level even for single horsemen, and no track proceeds through it.

The mistake of the earlier cartographers seems to have lain in assuming that a river would not break through a continuous range of mountains, presenting, be it noted, an unbroken face until close inspection revealed the slit-like gorge. The line of least resistance had been shown by dotted lines along the southern escarpment of the mountain chain of Mawat. There is no possibility of doubt about this matter, since I have personally seen the course of the river from its confluence with the Zab below Isa-awa village upwards to the *Shar Bazher* district, where it was known as the Qal'a Cholān. Lower down nearer the confluence, it was called successively the Ab-i-Qashan, Ab-i-Mawat, and Ab-i-Isa-awa (Ab- meaning water or river) conforming to the usual local plan of nomenclature.

Leaving Mawat, I rode down to the Pirt-i-Qashan, a crazy-looking structure across the Qal'a Cholān (or Qashar) river, which it spanned just at the point where it was about to enter the huge gorges by which it penetrated the high land of Mawat to reach the Zab. Crossing this and ascending to a pass by the edge of a ravine, I entered the long narrow valley of Dolbeshk where the road ran under avenues of trees between the high wooded slopes of the *Nelazen* and *Bardiu* ranges to east and west respectively, in due course re-emerging on the Qal'a Cholān river near the village of Konāmasi (fish spring). Here the country became very homelike, wide, fertile river meadows in the valley, and the hillsides clothed with verdure. Shortly after I forded the river near Mokaba and saw the confluence of the Siwal river coming in from the east. The ascent of the hills separating me from the Sulaimani plains was by a narrow wooded valley leading to the Qaiwan pass, descending obliquely from which I reached Sulaimani after a tiring ride of some eight hours.

THE DESERT FAYUM

THE DESERT FAYUM. By G. CATON-THOMPSON and E. W. GARDNER. [*London*]: *The Royal Anthropological Institute* 1934. 12×9½ *inches;* [*Text*] xiv+168 *pages;* [Separate volume of] cxiv Plates (with List, vii *pages*)*; illustrations and maps.* 30*s the two volumes*

IN these two finely printed quarto volumes Miss Caton-Thompson and Miss Gardner give a systematic account of the archaeological and geological investigations carried out by them in the northern part of the Fayum Depression during the three winter seasons 1924–5, 1925–6, and 1927–8. Some of the results of these investigations had been already described and discussed by the authors in papers published at intervals during the last ten years in various scientific journals; but archaeologists in particular will welcome this fuller and more detailed account, the value of which is greatly enhanced by its wealth of beautifully executed illustrations. The plates composing the second of the two volumes include not only maps, plans, sections, and photographic views of the various sites dealt with, but also photographs and scale drawings of the many hundreds of objects—stone and other implements, stone vases, pottery, beads, basketwork, wheat, and barley—which were found in the course of the excavations and which are now dispersed in a number of museums. The various objects date from Neolithic to Graeco-Roman times.

The principal geographical interest of the book lies in the conclusions arrived at by the authors in regard to the sequence of changes of lake-level, climate, and human activity in the depression from Pleistocene times onwards. The authors infer from their observations that two successive lakes fed by the Nile have existed in the basin of the Fayum, the first a Pleistocene lake which reached to a maximum height of 40 metres above the present sea-level and then eventually fell considerably below sea-level, possibly even completely drying up, and the second a Neolithic lake which reached to a maximum height of 18 metres above sea-level and was the direct, but far more extensive, ancestor of the historic Lake Moeris and of the modern Birket el Qarun. They consider that the history of the Neolithic lake has been one of intermittent contraction; that by the earliest dynastic times it had already fallen to just below sea-level, and that it has never since risen above that level; whence they conclude that

> "Lake Moeris, as described by Herodotus, could never have exceeded sea-level, and could not, at any historic period, have discharged into the Nile, or functioned as anything more than a sump (instead of as a regulated reservoir)."

and that

> "the reclamation work of Ptolemy Philadelphus within the Basin was the extensive irrigation and cultivation of desert land (not the draining of a high-level lake as a pre-requisite for such cultivation)."

A careful study of the evidence offered by the authors in the present book and in their earlier paper ("Recent Work on the Problem of Lake Moeris," *Geogr. J.*, January 1929, pp. 20–60), to which they repeatedly refer, has raised considerable doubt in the mind of the reviewer as to the validity of the two conclusions just quoted. While the authors' observations may be accepted as showing that the lake-level fell to 2 metres below sea during the latter part of the Neolithic period and remained sensibly at that level into the early dynastic period, there appears to be no real ground for denying the possibility of a subsequent rise to more than 20 metres above sea-level in middle dynastic times. No remains dating from the middle dynastic period appear to have been found at altitudes

lower than that of the Qasr-el-Sagha cemetery, which is about 24 metres above sea. Of course if it could be proved that the Neolithic and early dynastic remains which have been found at a level 2 metres below that of the sea have never been submerged, the authors' view that the lake has never since risen above that level would be completely justified. But such a proof has not been given. The state of preservation of the profile of certain parts of the beach at 2 metres below sea-level, on which Neolithic and early dynastic remains occur, might support the authors' view if it could be proved that the existing profile dates back to the early dynastic period; but there appears to be no definite evidence to preclude the possibility that the beach may only have acquired its final profile as lately as Ptolemaic times. And does not the contrast between the excellent state of preservation of the upper Neolithic granaries, some 32 metres above sea, and the "deplorable" condition of those at levels about 9 metres lower, rather suggest that the latter may have undergone submergence?

In regard to the level to which the lake surface descended in the Ptolemaic period, the authors do not give the evidence on which they rely in assigning a Ptolemaic date to the low-lying settlement at Tell-er-Rusas; and although they have stated in their earlier paper above referred to (*Geogr. J.*, January 1929, p. 47) that Ptolemaic villages, temples, and cemeteries exist at all levels in the Fayum province, from the City of the Arsinoites, the capital, at 23 metres above sea-level to Tell-er-Rusas at 40 metres below sea-level, it is striking to observe that not a single other Ptolemaic site is shown below the sea-level contour on the maps in the present book, nor do any appear below the sea-level contour on the official maps recently published by the Survey of Egypt. On the latter maps, the lowest-lying Ptolemaic sites shown are those of the towns of Euhemeria, Dionysias, and Karanis, all of which are at the sea-level; Theadelphia and Philoteris lie between the contours of 5 and 10 metres above sea, and Bacchias on that of 15 metres above sea. Unless the Tell-er-Rusas settlement can be definitely proved to date back beyond Roman times, it would seem reasonable to doubt whether the lake-surface can have descended to anything like so low a level as 40 metres below sea within the span of the Ptolemaic period.

The Ptolemaic shaft, lined with rubble stone, of which the authors give a vertical section on Plate 98, and which they describe as a "reservoir," cannot possibly have served as a reservoir in the ordinary sense of the word, but must have been merely the pit of a sakia (water-raising machine); this is evident both from the fact that by reason of the nature of its lining it would be incapable of permanently retaining water at a level higher than that of saturation of the ground around it and from the actual finding of sakia-jars within it, to say nothing of the shape of the excavation at the bottom, which was obviously scooped out to enable the sakia-jars to clear. The same purpose was doubtless served by the excavation and tunnel depicted on Plate 90, the tunnel being merely a device to secure percolation from a large underground surface in order to maintain a sufficient supply into the open part of the excavation; and it seems at least a likely supposition that all the channels forming the Ptolemaic irrigation system of which a plan is given on Plate 87 were supplied with underground water by water-raising machines. The underground water-level at the period when the "reservoir" was constructed is doubtless pretty accurately represented by the level of the top of the salt-deposit within it, which is about 2 metres below sea; while from the situation of the "reservoir" it is reasonable to suppose that the underground supply may have been kept up by percolation from pools occupying the neighbouring hollows and from the lake, the surface of which would thus at the time be at about this same level.

The idea that a fall of the lake-level amounting to as much as 27 metres might

have taken place as the result of reclamation operations during the forty years' reign of Ptolemy I has by no means the "inherent improbability" which the authors ascribe to it on p. 144. Such a fall would merely imply an average rate of lowering of 67 centimetres a year, which is only about one-third of the rate at which the level of the lake-surface could have been caused to subside by complete closure of the Nile connection, supposing the rate of evaporation to have been the same as at the present day.

In any future work of this kind in Egypt it is to be hoped that the system adopted for levels will be the same as that employed on the official maps and by the irrigation engineers of the country, namely, metres above or below sea-level. Probably nothing has done more to obscure a difficult subject than the authors' adoption of the foot as unit of height and the present-day surface-level of the Birket el Qarun as a datum.

It may be remarked that owing to reduction in printing, the scales of the maps in the book do not accord with the fractions figured on them; for example, the scale of the maps forming Plates 109 to 114 is not 1 : 100,000 as stated, but about 1 : 117,000; and this will give rise to difficulty for any one who may be desirous of directly collating these maps with those of the standard 1 : 100,000 series published by the Survey of Egypt. It would have been better if the original scale had been retained in reproduction; and this could easily have been done without increasing the height of the plates, by merely omitting an unimportant part of the area shown on them. J. B.

REVIEWS

EUROPE

MÉDITERRANÉE: PÉNINSULES MÉDITERRANÉENNES. Italie. By JULES SION. Pays Balkaniques. By Y. CHATAIGNEAU and JULES SION. (Géographie Universelle. Edited by P. VIDAL DE LA BLACHE and L. GALLOIS. Tome VII. Deuxième partie.) *Paris: Armand Colin* 1934. 11½×8 *inches;* 235–598 *pages; illustrations and maps.* 100 *fr*

This new volume in the great series of the "Géographie Universelle" ranks among the best which have yet appeared. Illustrated with the profusion of diagrams and photographs characteristic of this great undertaking, it is written with the limpidity of style and the lucidity of argument which have come to be associated with French geographers.

Possibly, in achieving a clear picture, there is a tendency to smooth over the difficulties, and to avoid awkward facts which will not fit into the main argument, so that the relation of cause to effect is shown to be more simple than one suspects to be the case. For instance, it is doubtful whether many geographers, more especially the historical geographers, would agree entirely with the following statement about the Balkan Peninsula: "De cet enchevêtrement d'aires de relief, de climat, de sols et de végétation résulte pour les populations une grande diversité de tempéraments et de genres de vie." It may be questioned also whether it is either sound geography or sound psychology to generalize about the mental characteristics of whole groups of people as M. Chataigneau ventures to do on p. 408: "Le montagnard slovène, patient, méticuleux . . . le Croate, pétillant de gaîté, le Dinarique, vif et imaginatif . . .," and so on, with a neat descriptive adjective for the Macedonians, for the Serbs of the Šumadia, for the Bulgarians of the Danubian platform, of the Stara Planina and of the Maritsa, for the Turks, for the mountaineers of the Rhodope, and for the Albanians.

On the side of physical geography there seems a similar tendency to gloss over the difficulties. It is assumed for instance (p. 397) that the Rhodope massif is directly comparable with the Hercynian masses north of the Alps, and no mention is made of Kober's theory of the *Zwischengebirge*. Nor, on referring back to volume I, which deals with the generalities of the Mediterranean region, can one find any mention of this theory, nor any adequate treatment of tectonics which would justify the small amount of attention given to them in this second volume. To take another instance, this time from the climatic side. Remarkably little is said about the peculiar winds of the Balkan Peninsula, or of the conditions of atmospheric pressure in which they occur, whereas one might reasonably expect to find a full analysis of the Bora, Šilok, Košava, etc., in a work of this magnitude. Surely also it is begging the question to say that *terra rossa* is formed by "laterisation," and the black earth (*chernozium*) by "rubefaction," without giving further explanation.

On the economic side also opportunities are lost. It is a pity that the authors have not availed themselves of the space at their disposal to tackle some of the more difficult economic questions, such as the problems connected with the agricultural systems of the Balkan Peninsula and the handicaps these antiquated systems impose on the exploitation of the soil.

The great merit and strength of the work lie indeed not so much in formal scientific analysis as in synthesising the material into detailed descriptions of natural regions. The authors have made use of a remarkable amount of literature, including monographs and other works in Serbian and Bulgarian. They have

carried out extensive inquiries in the countries concerned. They bring to a particularly fascinating area the charm of enthusiasm. The results of this intimate study are seen not only in the freshness and vividness of the descriptions, but also in their excellent accounts of recent developments and changes. Among these may be mentioned Italy's great efforts in reclaiming the Pontine Marshes, the Campagna Romana and the low-lying lands of the Po delta, the attempts to reafforest the Apennine region, and the great hydro-electric enterprises, all described by Professor Sion. In the chapters on Greece the same author writes eloquently of the renaissance of Athens, of the efforts at absorbing the Greek refugees from Anatolia and of their settlement on the plains of Macedonia. M. Chataigneau gives an account of the less well-known changes in Yugoslavia, particularly of the movements of Serbs into Macedonia and Bosnia. He deals also with the changes in relative values due to the extension of the railway systems in the Balkan Peninsula and to the alterations of boundaries. The rapid growth of the towns is emphasized. For instance, the number of inhabitants in Belgrade increased from 115,000 in 1921 to 241,000 in 1931; in Zagreb the numbers increased from 74,000 in 1910 to 186,000 in 1931; in Skoplje, from 45,000 in 1921 to 65,000 in 1931.

In regard to the regional descriptions it is interesting to note the amount of space devoted to Italy and Greece compared with that given to Yugoslavia and Bulgaria. Fifty-seven pages are allotted to the 50,000 square miles of Greece, whereas the 40,000 square miles of Bulgaria have only 23 pages. The regional description of Italy's 112,000 square miles takes up 125 pages, whereas Yugoslavia's 96,000 square miles have only 56 pages. Yet it cannot be said that the descriptions of Yugoslavia and Bulgaria suffer from compression, nor that those of Italy and Greece are too long-winded. In regard to the latter countries, the difficulty of giving a concise account is inherent in their geographical nature. The extremely compartmented character of these peninsulas, their mosaic of small land-forms, demand a great amount of detail in the description. Often these districts are so small and the differences so slight that a reader living outside the countries concerned, and considering these lands from a distant armchair, might be justified in questioning the usefulness of these *minutiae*, but to any one who wishes to understand the internal problems of these countries, this piling up of detail is essential. The cumulative effect brings out the real awkwardness of these mountainous areas from the point of view of internal administration and does much to explain their past and present problems. Among these problems at the present day may be noted the almost insuperable difficulties which lie in the way of regulating the disastrous erosion in the Apennines, and the many obstacles which beset any attempts to improve the standard of living in the same area. Even Professor Sion however is inclined to doubt whether the methods of social amelioration at present adopted in the Apennines are the right ones, in spite of his resolute attempt to maintain an attitude of detachment. As a companion to classical studies both the section on Italy and that on Greece, but particularly the latter, are extremely valuable. Professor Sion is remarkably good for instance on the islands of the Aegean and the *lack* of seaward outlook on the part of the inhabitants, and he pours the cold water of common sense on much that has been written about "geographical control" in regard to the Peloponnesus and Attica. Is it however too much to ask that Professor Sion will use the accepted local names as well as their French equivalents? English people no doubt are equally culpable in regard to the names of world-famous places, but Plaisanca for Piacenza, Poiulles for Puglia surely carry provincialism a little too far.

M. Chataigneau's task in regard to Yugoslavia, Bulgaria, and Albania was

possibly easier than that which confronted Professor Sion. In dealing with areas which are much less well known than Italy and Greece he had all the fun of the pioneer, and less to fear from comparison with earlier writers. Taken as a whole however there is no doubt that this work contains the fullest and most authoritative account of Italy and the Balkan Peninsula which has yet appeared in a single volume, and it will be long before it is surpassed in attractiveness either of writing or of presentation. M. R. M.

AFRICA

JEUX ET DIVERTISSEMENTS ABYSSINS. By MARCEL GRIAULE. (Bibliothèque de l'Ecole des Hautes Etudes. Sciences religieuses. XLIX^e^ Volume.) *Paris: Ernest Leroux* 1935. 10×6½ *inches;* 258+xxvii *pages; illustrations.* 75 *fr*

M. Griaule's catalogue and exposition of every activity which conceivably may come under the head of this comprehensive title, must be a unique and standard work. Only those who know the almost insuperable difficulties which confront the student and traveller in Ethiopia can appreciate the enterprise and labour behind this book.

Essentially a text-book, it infers a greater knowledge of Amharic and Abyssinia than the average reader possesses; but the author disarms us, in his preface, by submitting that the function of the ethnographer is not to comment, but to document; this he has done most effectually and with illuminating plates and a chart.

From the chapter "Combats, Insultes," it would appear that, on feasts of the Cross and Transfiguration, legalized warfare is permitted between Montagues and Capulets of rival villages. Children flay each other with whips (lashes 4 metres long) and are later joined by their elders in a pitched battle. This ends in casualties, the victims losing eyes, ears and even life, for which the authors are not held responsible in law!

The chapter on Brimades (ragging) suggests a system of "survival of the fittest" more suited to a primitive race than our public schools. For the rest, "plus ça change, plus c'est la même chose." The youth of Amhara play forms of hockey, rounders, hide and seek, football, hopscotch, naughts and crosses (p. 177), forfeits (p. 147), do physical exercises and trials of strength and ingenuity. Waits have their counterpart in "Vols. Quêtes." Toys seem to vary little through the ages, and whistles, tops, and dolls are all to be found. There is an enterprising young savage who tried to fly!

The story-telling and efforts at drawing and music of these Abyssinians, and the complicated rules and seasons of their more serious games, are all meticulously recorded by M. Griaule in this Badminton of Ethiopia. E. N.

NORTH AMERICA

THE SETTLEMENT OF THE PEACE RIVER COUNTRY. By C. A. DAWSON, assisted by R. W. MURCHIE. (Canadian Frontiers of Settlement. Edited by W. A. MACKINTOSH and W. L. G. JOERG, Vol. VI.) *Toronto [and London]: The Macmillan Company* 1934. 10×6½ *inches;* xii+284 *pages; illustrations and maps.* 18*s*

The first volume of this series which has already been noticed in the *Journal*, vol. 84, pp. 531–2, dealt with the general problems of pioneer settlement in Canada. The book here under review treats the same questions in a more strictly limited region, the Peace River Country. Those who attended Miss

Cecilia Goodenough's attractive lecture to the Society on "Homesteading in North-West Canada" (*Journal*, vol. 83, pp. 191–6), will find much to interest them in this volume. It must be emphasized that the book is written by two professors of sociology, and is therefore more closely concerned with social than with geographical questions.

The development of the Peace River Country is very recent history. The period between 1916–21 was a time of expansion and was followed by five years of recession. The region was very isolated until the railway reached Peace River town in 1916. The authors have therefore been able to make a careful study of a district in the very early stages of development. The region "is the present-day representative of that agricultural frontier which entered the central plain of North America in the late eighteenth century. In the Peace River Country, on a smaller scale and with differences appropriate to the conditions and knowledge of the present day, the experience of the agricultural frontier is being recapitulated. . . . The familiar historical occurrences of the premature or false beginning, the long wait for transportation facilities, the land boom and its collapse, the early groping for suitable agricultural practices, the search for suitable products, the evolution of mature and stable settlements—these are contemporary history in the Peace River Country."

The book is full of carefully compiled statistics of such data as the changes in the size of farms, sex and age groupings, farm family expenditure, social institutions including religious, educational, and health organizations. A large amount of this information will be more useful to the sociologist and the economist than to the geographer, but the text of the book as a whole, combined with the numerous photographs, gives a good general picture of the present development of a region which is being rapidly transformed by human activity. E. W. G.

ALASKA NATIVES: A Survey of their Sociological and Educational Status. By H. DEWEY ANDERSON and WALTER CROSBY EELLS. *Stanford, California: University Press* (*London: Humphrey Milford*) 1935. 11×8 *inches;* xvi+472 *pages; illustrations and map.* 22*s* 6*d*

In an introductory note to this interesting report on the natives of Alaska the Dean of the School of Education of Stanford University states that although Alaska has been under American control since 1867, no comprehensive study of educational conditions, needs and results in the Territory has ever been made, and that "it has been the work of the staff directing the present study to collect such information by a careful on-the-ground investigation of the educational possibilities and needs of the native peoples, and to make an evaluation of the educational system so far provided for them."

The ambitious program which the investigators set before themselves appears to have been very ably carried out. Dr. Anderson, Assistant in Educational Research at Stanford and director of the survey, was accompanied on all his journeys by Mrs. Anderson, a trained Binet Intelligence Test examiner and an experienced educational and social worker. They spent fifty-one weeks in the field, the first trip beginning 1 July 1930 and ending 25 March 1931, and visited thirty-two of the forty-eight Eskimo villages in which the government is conducting school and community work. Dr. Eells, who spent only a few weeks in the field, wrote the chapters on tests and mental measurements, collaborated in others and shares with the Director the responsibility for recommending numerous improvements in the educational system. At the request of the United States Commissioner of Education the survey concentrated on the problems of the Eskimos and Aleuts, the data including Indian tribes only when it was found impossible to segregate the available information on a racial basis.

The first part of the book is sociological, and after a review of the opinions currently held about the origin of the Alaska Eskimos there is a rather detailed account of the people and their culture as it was at the time when Europeans first encountered them. The material for this was gathered from many sources, some of them Russian, and it has been arranged in such a manner as to facilitate comparisons with the corresponding features of contemporary Eskimo life, which is described in the following section.

The authors endeavoured to determine the "psycho-social characteristics" of the present-day Eskimos, partly in the hope of supplying the prospective teacher with an "attitude set" based on as reliable and objective data as possible. A list of thirty-one traits (such as hospitality, modesty, stoic endurance of pain, competitive spirit, fear of the shaman, etc.) was submitted to thirty-four judges, who indicated the extent to which they felt the traits applied to the Eskimos by marking them "very," "pronounced," "somewhat," "seldom," or "never." The basis of selection of the judges was "a general estimate of intelligence, interest in the Eskimos, long association with them over a wide extent of their habitat, and representation from various walks of life." Among them were Eskimos, Whites married to Eskimos, scientists, school superintendents, school teachers and nurses, missionaries and traders. Although this method is open to obvious criticisms, the most serious being that these vaguely defined traits probably did not mean the same thing to the different groups of judges, it makes commendable use of the knowledge possessed by local residents, sometimes neglected by modern travellers.

Part Two is devoted to an educational study of the Alaska natives. Besides a thorough description of the school system there is an account of the tests given to the children. The results of the tests of mental, mechanical, physical and musical ability seemed to indicate that the native races were inferior to the white race in "inherent ability," but the investigators admit that the number of cases is too small and the conditions of measurement too unsatisfactory to permit of any final pronouncement. The series of tests which measured scholastic achievement revealed a tendency for the Eskimo children to fall increasingly behind the standard for the corresponding form in the United States until the sixth school year, but after this point they recover and for the few pupils that were tested in the tenth school year the deficiency was very slight.

The detailed recommendations made by the authors include administrative reorganization, improvement in the preparation and qualifications of the teaching personnel, a health program, adequate buildings and a reform of "the present subject-centred, formal curriculum, copied too much from that of white schools in the States." They feel that an indigenous one should be worked out, made up of activities "fundamental to the economic and social life and well-being of the natives."

There are some interesting reproductions of children's drawings, but the photographs are rather small and not very clear. It is difficult to read some of the names on the two general maps, which are scarcely large enough for their purpose.

E. J. L.

CENTRAL AND SOUTH AMERICA

DIE INSELN ST. THOMAS UND ST. CROIX: eine vergleichende wirtschaftsgeographische Untersuchung. By ROLF BERGER. *Hamburg: J. G. Bitter & Sohn* 1934. 9×6 *inches;* viii+130 *pages; sketch-maps.*

Herr Berger has undertaken a thorough study of these two islands of the Lesser Antilles from every point of view. He sketches their economic history as ports

of call for the early transatlantic navigation and as sugar plantations. He deals with the climate, population, health, flora, and fauna of the islands and traces the economic effects of the liberation of the slaves, the opening of the Panama Canal, the Great War, and the purchase of both islands by the United States in 1917. For the future Herr Berger sees the possibility of a return of prosperity to the island of St. Croix only should the world market for sugar expand. St. Thomas on the other hand has owed all its prosperity to the fact that until lately all navigation has been to a great extent dependent on ports of call, water and coaling stations; and the more efficient and self-supporting navigation of to-day, and before all else the advent of the aeroplane, have made the prospects of St. Thomas to all intents hopeless. M. C.

AUSTRALASIA AND PACIFIC

L'ISOLA DI PASQUA. By E. C. Branchi. *Santiago [Chile]: Istituto di Cultura Italiana* 1934. 10×7 *inches;* 192 *pages; sketch-maps and illustrations. Pesos* 10

This is a full-length study of the history and topography of Easter Island, followed by an account of a visit there made by the author in 1933. Signor Branchi has fallen under the spell of the island and its inhabitants, and he very properly finds nothing too bad for the various plunderers—from Peruvian slave-dealers to French adventurers—who have at various times tried to exploit either the geographical position of Easter Island as a possible port of call for transpacific navigation, or its isolation and remoteness from any civilization, which has attracted the attention of generations of unscrupulous people. On the other hand, he cannot praise too highly the French missionaries, Eyraud and Roussell, who went to evangelize Easter Island in the 'sixties of the last century and, inheriting all the odium accumulated against the generations of white exploitation, yet contrived in the end to convert the whole island to the Christian faith. There are most interesting chapters on the religious and social habits of the islanders, the history of the internal dissension among rival tribes at different times, and the ethnological problem raised by conflicting internal evidence as to the original *provenance* of the islanders. Unfortunately the illustrations are poor and unworthy of Signor Branchi's well documented text. M. C.

POLAR REGIONS

THE SEARCH FOR THE NORTHWEST PASSAGE. By Nellis M. Crouse. *New York: Columbia University Press [London: Humphrey Milford]* 1934. 9½×6 *inches;* 534 *pages; illustrations and map.* 20*s*

This well-printed book, issued by a great university, is mainly devoted to explorations of the early nineteenth century, beginning with Scoresby in 1817, and ending with McClure in 1853. "Mainly" in space, though not perhaps in value. For, in some ways, the most important chapter is the thirteenth and last, recording Roald Amundsen's complete discovery of what "might conceivably be called" a North-West Passage, in 1903–6. "I am exceedingly pleased to be the first to welcome you, on getting through the North-West Passage," was the business-like greeting of Captain James McKenna of San Francisco on meeting Amundsen near Nelson Head, and surely all readers of this *Journal* will say likewise. Particularly as, not being Scandinavians, they may not have found the Amundsen record quite so accessible as those of John Ross and David Buchan, of William Edward Parry, John Franklin, or Robert McClure.

Especially interesting perhaps in this last chapter is the record of Amundsen's efforts to equip himself as a practical seaman, even beginning before the mast, and working himself up to mate, thus securing a berth on the *Belgica*. By this he saves himself from the derogatory need of so many other explorers, and can dispense with a nautical colleague, and avoid a divided command (p. 482).

And especially pleasing is the little tale of the effort to bring back an Eskimo lad to Europe. Good plump little Tonnich, "tallest when lying down," now thoroughly scrubbed, his hair cut short and well sprinkled with insecticide, is dressed in a suit of European underwear; and in this dazzling garb, swollen with pride, even beyond his usual rotundity, he displays himself to his jealous friends. Alas, the laugh is with those envious ones, for Tonnich, home-sick at last, finally makes the great refusal.

Mr. Crouse naturally gives exceptional attention to the explorations of Franklin, McClure, and Parry. If Amundsen, he remarks, first discovered a navigable passage, Franklin, McClure, and their men (as so often claimed) were the first to trace the connecting link between Barrow Strait and the waters off the northern coast of America, thus proving the existence of a passage between the two oceans (p. 477). Yet "Franklin's discovery can scarcely be compared with the achievement of McClure, for the former perished in Victoria Strait, and his men . . . abandoning the ships, just managed to reach the mainland, where they died of starvation" (pp. 450–1). While Captain McClure, the author considers, may fairly be credited with the practical discovery of the North-West Passage, by proving the existence of a continuous route from sea to sea through Bering Strait. None the less, when, years later, a ship was at last able to make the whole journey from Atlantic to Pacific, it was by following Franklin's route; it has never been found possible to work a vessel through the passage of Captain McClure (p. 457).

Mr. Crouse seems to suggest that with Amundsen's achievement we have the completion of an enterprise initiated by John Cabot, "who first conceived the idea of reaching Asia by sailing westward over a northern route." Yet surely more precision is needed here. John Cabot cannot fairly be described as seeking a north-west passage. He, "another Genoese like Colon," is seeking Asia over the open ocean of the west. And by a more northern route than Colon, to avoid a conflict with the Spain which had sent out the great discoverer—and had already gained her title to more southern "West Indian" regions. Quite early in the next, the sixteenth century, we are threading our way among references to such a passage—as among icebergs—for men had begun to realize that "this new land found lately" was not Eastern Asia. But this is hardly the navigation of John Cabot. R. B.

CARTOGRAPHY

THE MAP OF THE BRITISH ISLES OF 1546. By EDWARD LYNAM. *Jenkintown (Pennsylvania): The George H. Beans Library* 1934. 12×9½ *inches; 6 pages; photostat reproduction (in two sheets).* $2·50

This well-produced publication (No. 9 of the "Publications" of the George H. Beans Library) is to be welcomed not only as giving for the first time a full-size reproduction of a landmark in the cartography of these islands (those previously available, including that issued by the British Museum in 1928, having been more or less reduced) but because Mr. Lynam's accompanying memoir makes the first at all adequate attempt to discuss in a scholarly way the problems connected with the map; for as in so many like cases, we have largely to fall back on guess-work in considering the circumstances in which it took shape.

Generally known in recent years as the work of George Lily, who after his banishment from England in 1543 lived for a time at Rome (where the map was produced) in the entourage of Cardinal Pole, it still bears no name of author, being merely put down as made "Anglorum studio et diligentia." The ascription to Lily rests in the first place on the presence of his monogram (G. L. A. accompanied by three lilies), but there is other evidence in the same direction, as Mr. Lynam shows in his careful discussion of its authorship, particularly the statement of Bishop Paulus Jovius in his 'Descriptio Britanniae (1548),' for which work Lily had supplied valuable data.[1] A good many years later John Pits (1619) definitely stated that Lily drew the map though others undertook its engraving. Mr. Lynam remarks that the plural "Anglorum" shows that others besides Lily had a hand in its preparation, and regrets that we have no clue to their personality, though he thinks they were probably other learned Englishmen then resident in Italy. May it not merely mean however that Lily had obtained some of his data by correspondence with other Englishmen? A strong confirmation of Lily's authorship is the insertion of three Hampshire towns not shown on any previous map, one of them—Oldham—being the home of his family.

Another point discussed is the re-appearance of Lily's monogram on the 'Nova Germaniae descriptio,' published by Tramezzino in Venice in 1553. (It was reproduced by Wieder in Part I of his 'Monumenta,' and was briefly discussed in the review of that work in the *Journal*, vol. 71, p. 188.[2]) Mr. Lynam adopts the suggestion made in that review that the monogram referred to the granting of the Papal "privilege," but goes a step further in suggesting that Lily acted as general editor of maps issued under the auspices of the Church. The mere granting of the Papal licence to print would hardly perhaps bring maps enjoying it into that category, for the Germany at least obtained a similar licence from the Venetian Senate as well as the Pope. Mr. Lynam mentions that Pole and Lily stayed at Dillingen (where one of the four existing copies of the map is still preserved) on their way back to England, and suggests that the licence to print the Germany may have been granted then.

In regard to the sources used Mr. Lynam shows that Lily must have had knowledge (direct or indirect in the first case) of two earlier maps—the "Bodleian" of *c.* 1300 or rather later, and Münster's engraved map in his Ptolemy of 1540. There is no evidence that he used the anonymous "Cotton" map in the British Museum of about the same date. Mistakes in the Bodleian map are repeated by Lily, and there are other errors pointing to scant care in revision. It is not quite clear why Mr. Lynam puts down as such the "Puteus Peke" of the Peak of Derbyshire. Is it not rather evidence of real knowledge, for we know that for centuries a superstitious awe attached to Eldon Hole near Castleton, credited even by Defoe (on Cotton's authority) with a vertical depth of a mile?

We can merely mention Mr. Lynam's careful discussion of the basis of the degree-net, and of the length of the mile, adopted in the map, which leads in fact to no very certain conclusions. He mentions the eight re-issues or derivative maps which appeared in the same century, the most interesting being that of Thomas Geminus (London, 1555) printed from the original plate with but slight alteration. He does not refer to Bagrow's statement (*op. cit.*, p. 101 *note*)

[1] It is perhaps worth noting that according to Bagrow ('A. Ortelii Catalogus' I, p. 101), the map itself was attributed by Gesner to Jovius. Though not strictly correct, this at least shows the close association of the map with the Bishop's work.

[2] The Society has since been fortunate in acquiring a copy of the rare original in a so-called "Lafreri" collection.

that an edition was brought out in 1548 by Gourmont in Paris. This is possibly an error, but it is a matter which it would be well to clear up.

One may perhaps regret that two of the four known copies of the map should lately have found their way to America, both being now in the Beans Library, which specialises on early Italian work of the kind. But students will be grateful to Mr. Beans for making available both this and other treasures by his series of publications, and appreciate his wisdom in entrusting the present memoir to the competent hands of Mr. Lynam. E. H.

ECONOMIC AND HISTORICAL GEOGRAPHY

LE RHIN: PROBLÈMES D'HISTOIRE ET D'ÉCONOMIE. By ALBERT DEMANGEON and LUCIEN FEBVRE. *Paris: Armand Colin* 1935. 9×5½ *inches;* xii+304 *pages; maps.* 26 *fr*

Throughout the whole length of European history—and this must now be conceived to include several millenia at least which are revealed to us by archaeology—great rivers such as the Rhine have played many and important parts. In varying degrees at successive stages of culture this river, with or without its appendant lands, stands out as a route-way, a zone of urbanization, as a frontier, and even as a source of motive power. It is not surprising, in view of the close and complex way in which human activities are and have been inter-related with the Rhine, that this river should have become a fascinating study to the historical geographer. The work here under review, from the pens of two distinguished French professors, adds, it is true, yet another volume to an already extensive literature on the Rhine. It finds its justification however in that it presents a study of many aspects of the river's "personality" past and present in a compact and readable form, and moreover does this with all the effectiveness which derives from scientific treatment. It should be emphasized at once that 'Le Rhin' has no kinship with the many books of those who see epitomized in the Rhine, primarily if not exclusively, an age-long history of Franco-German rivalry. Not the least virtue of this book is its sane evaluation of the many aspects of the history of the Rhine and its concentration on the human activities in the Rhineland under conditions of peaceful intercourse, rather than on those less characteristic yet more spectacular episodes of its history in times of war.

'Le Rhin' consists of two parts, the first by Febvre, the second by Demangeon. The subject matter of the two parts, though not very sharply demarcated, is essentially complementary. It is significant that there is not in this book any rigid division, as used to be common especially in English works, between sections labelled "geography" and "history," as if these two studies were related somehow yet at the same time quite distinct. The division of the book is clearly an attempt to share the task of writing so that each of the two writers is able fully to develop his own particular interest in this broad subject. Even so, although Professor Febvre's interest lies in the geography of history whilst Professor Demangeon is an expert on present-day geography, both are united in their conception of geography as concerned inevitably with both the present and the past. Their work in fact serves to call attention once again to that happy academic tradition in France of studying history and geography side by side as one indivisible whole.

In his half of the book Febvre, ranging widely throughout the Rhinelands, examines some parts of their many-sided history from the times before Caesar down to those of Bismarck. He does this with his accustomed critical and analytical vigour, in his own peculiar style, which is marked by its fund of

allusions and its addiction to the use of interrogatory and exclamatory sentences. He believes that history is simple only to the simple, and that it is even desirable to complicate questions in order to discover truths. His closely packed and closely argued chapters, with their wealth of historical material, must prove difficult to the geographer ungrounded in history. There is certainly more history here than need be hammered out on the anvil of historical geography so-called: Febvre is very interested in the wider problems of history as such. But certainly for the careful reader these stimulating chapters throw into sharp relief many of the permanent and ephemeral elements in the past geography of the Rhinelands. In particular, Febvre is at pains to efface the popular conception of the Rhine as a persistent frontier of conflict, and to show, in contrast, that it was characteristically rather a region of contact and intercourse. Thus he emphasizes how little ground exists for the notion that the Rhine consistently formed a dividing line between races, peoples or cultures. So, too, he shows how rarely and then only very partially, it formed a boundary between states. What he writes (pp. 39–40) on the ninth-century divisions of the heritage of Charlemagne, which foreshadowed for the first time the kingdoms of France and Germany, may be recommended as a brief statement of what is now held on a subject about which much nonsense has been written.

In the second half of the book Professor Demangeon examines the physical conditions of the Rhine in relation to navigation, and describes the ways in which the river has been improved as a waterway. Further, he explores in some detail the economic function of the Rhine as a route-way throughout history. His style of writing is simpler, more direct, and less provocative than Febvre's. His emphasis is on the trade of the river and its ports in the age of coal and steel in which it is our lot to live, and he does this with the aid of statistics and maps, and with an eye always to its development through time. He brings out the changing importance of the Rhine as a route between two of the most populous and industrialized parts of western Europe—the Low Countries and the north Italian plain. No less interesting is his study of the Rhine seaports below Cologne: this is a very recent phase of geography, since for many centuries Cologne had no rival downstream and traded either direct to the sea or overland to the ports of Bruges or Antwerp.

In short, 'Le Rhin' is yet another product of French geography which must find a place in university libraries. Informative, and at times at least stimulating, it sustains the thesis that the Rhine has served Europe continually as a great highway of culture rather than as a barren dividing zone of strife. It makes no attempt at comprehensive treatment, and for full detail, especially on the physical side, the student of the Rhine will still turn to the volumes of 'Der Rhein' which are edited by Haushofer. The writers of 'Le Rhin' have been so careful to avoid the contentious political aspects of their subject that there is no discussion of the regionalism of Alsace, somewhat analogous to that of Catalonia in Spain. Again, it is difficult to assess the part played by the Rhine waterway in transport unless more figures are given showing how much freight is carried by railways. Further, the authors have little to say about the siting, as distinct from the wider positional aspects, of the ancient Rhine towns. The book includes a useful, short, and up-to-date bibliography, but has no index. Although one has little reason to expect to see English works included in the bibliographies of French geographers, one might have expected to see included Mackinder's 'The Rhine,' much of which may still be read with profit. W. G. E.

GENERAL

THE VOYAGE OF THE TAI-MO-SHAN. By MARTYN SHERWOOD. *London: Geoffrey Bles* 1935. 9×5½ *inches; viii+270 pages; illustrations and sketch-maps.* 12*s* 6*d*

Here is an account, and a very good account too, of a voyage undertaken under sail by five naval officers in a 23½-ton ketch from Hongkong to Dartmouth, accomplished in one day under the year.

Designed—with the assistance of a technical expert to whom proper thanks are accorded—by themselves, the idea conceived by themselves, stored and fitted out by themselves, the voyage and the account of it are valuable additions to what may without detraction be called minor expeditions.

The author in his preface disclaims any literary merit. He need not be troubled on that account. The free and pleasant style of his narrative compensates for that.

There may not be much fresh geographical information, but there is an immense amount of practical advice based on the experiences undergone. No words are lost on these points, especially in the appendices. It can be readily understood that great care was required in the organization necessary to carry five men in so small a space. Modern appliances were made use of, a ½-h.p. generating plant charging the batteries which supplied both the electric light and the power for wireless installation. The good fortune which follows forethought, good organization, and skilful execution was theirs. Difficulties and hardships there must have been, more than appears in the book. The grounding at Crooked Island which nearly led to the loss of their vessel is matter of great interest and affords a lesson to all seamen and to others as well. That the *Tai-Mo-Shan* was refloated with little material damage reflects great credit on the captain and crew.

All worked happily together. A common upbringing in a common service produced a harmonious crew. Great credit is due to the captain, or, as the author prefers to call him, the sailing master, Lieut. R. E. D. Ryder.

However well served, and no one could have been better served, it is the captain who must bear the responsibility to whom credit must be accorded. His experiences will be invaluable to him in his present command in the Antarctic.

It is to be regretted that the typhoon season prevented any attempt to find Ganges Island, the existence of which is very doubtful, and that either it or the E.D. which is shown on the chart might be removed.

The encouragement given by all, especially by the Admiralty, to this voyage is a great encouragement to enterprise the outlets to which are innumerable and ever fresh in direction. W. E. G.

OVER MY SHOULDER. By BERNARD MARTIN. *London: Duckworth* 1935. 8½×5½ *inches; 272 pages; illustrations and sketch-map.* 10*s* 6*d*

This is the record of a journey through Ceylon, Australia, New Zealand, Java, Malaya, Siam, Burma, China, and Japan, across the Pacific, and through Canada home. It is pleasantly written, neither over informative nor rhapsodical. Mr. Martin is a sympathetic and observant traveller, and if he has found little new to say about any part of the world that he visited, he says the old things interestingly. M. C.

THE MONTHLY RECORD

NAMES OF COUNTRIES USED BY OTHER COUNTRIES

In the *Journal* for May we published a "Table of Countries' Names in European Languages using the Latin Alphabet," and expressed our readiness to publish any necessary corrections to it. Three correspondents have written to point out errors, and we are glad to summarize their communications here. The Secretary of the Royal Netherlands Geographical Society, Mr. E. J. Vouté, writes that the usual Netherlands form for Great Britain is "Groot-Brittannië," that "Groot-Britannië" is also used, but that the form given in the list, "Groot-Brittanje," is archaic and poetic. He also points out that "Denemark" is an error for "Denemarken." The main point he raises however concerns the official name for his country which was given in the list as "de Nederlanden," on the analogy of "Koninkrijk der Nederlanden" and on the authority of a recent dictionary. Mr. Vouté points out that "The Kingdom of the Netherlands" is the constitutional term for the state, including its colonies, and that the official name for the territory in Europe is "Nederland"—the current English term "Holland" not being officially recognized. He also draws attention to a circular issued in January 1935 by the Netherlands Foreign Office and Department of the Interior requesting that in English-speaking countries the use of the words "Dutch" and "Dutchman" should be abandoned in favour of "Netherlands" and "Hollander." The ground for this request is the ambiguity arising from their similarity with "Deutsch." There is no reason however why the official "Nederland" should not be used as an adjective; the word "Hollander" is not very happy, as strictly it would refer to an inhabitant of the province of Holland only.

The Secretary to the Yugoslav Legation writes that to bring certain of the Serbo-Croat forms into line with the remainder of the list it is preferable to use "Portugalija," "Estonija," and "Letonija" for "Portugalska," "Estonska" and "Letonska." The second diacritical mark was also omitted from "Čehoslovačka." Another correspondent, Mr. David Francis of the British Vice-Consulate at Praha, also draws attention to a similar tendency in Czech. The name used for England in official publications is "Anglie," and not "Anglicko," which, although analogous to "Německo" and other forms, is now regarded as a colloquialism.

RAINFALL OF GREECE

A detailed study of the distribution of rainfall over Greece and the Grecian archipelago is given by Professor E. G. Mariolopoulos in a paper entitled "Étude des Régimes Pluviométriques de la Grèce," published in *Annales de l'Observatoire National d'Athènes* (tome vii, 1934). The investigation is based on some sixty stations for the thirty-five-year period 1894–1929. The country, as is well known, belongs to the general Mediterranean province of summer drought and winter rains, but there is considerable variation in the local and monthly distribution of average rainfall due to the interlocking of land and sea and complexity of relief in relation to prevailing winds and paths of atmospheric depressions. The rainfall decreases from north to south, and more strikingly from west to east in consequence of the disposition of mountain ranges with respect to south-westerly winds in winter. It is as high as 56 inches at some places in Epirus in the north-west, but falls as low as 8 inches at the eastern end of Crete.

There is however conspicuous local interference with the general decrease of rain from north-west to south-east. Thus in Thessaly north-easterly winds in winter charged with vapour from the northern part of the Aegean Sea raise the rainfall of the coast and the Northern Sporades above that in the interior, and the eastern slopes of Mount Pelion are wetter than the western. In like

manner the long inlet of the Gulf of Corinth causes considerable irregularity in the course of the iso-hyetal lines since it interrupts the chain of mountains and allows moisture to penetrate farther east.

Over the greater part of Greece July is typically the dry month and December the wet month, but the monthly distribution of rainfall is sufficiently complex to allow of the stations being arranged in three main groups. These are: (A) *régime littoral*, characterized by a simple annual variation with a single maximum and minimum; (B) *régime continental*, showing a double oscillation with a secondary maximum and minimum; (C) *régime rare*, giving a triple oscillation with three maxima and minima. Each of these groups is subdivided into a number of *types* according to the particular months in which the several primary or secondary maxima and minima occur.

Regimen A covers the greatest area, embracing the coasts and islands as well as the western interior of the mainland. It comprises five types. In regimen B the more continental conditions of the interior and northern part of Greece are associated with such a degree of monthly irregularity that as many as a dozen types are recognized. This regimen reflects the tendency in the continental parts of the Mediterranean for spring and autumn rains in addition to the principal winter rains. Regimen C represented by only four stations within the area covered by B contains nevertheless three different types according to the months exhibiting the several characteristics.

In Athens, where the average annual rainfall is only 15 inches, observations extending back to 1860 show a principal minimum in July, a principal maximum in November, a secondary minimum in April, and a secondary maximum in May. This is the dominant type of seasonal variation in the continental regimen.

NEW SUNSHINE VALUES FOR BRITISH ISLES

Publication No. 377 (1934) of the Meteorological Office on "Averages of Bright Sunshine for the British Isles for Periods ending 1930" gives the distribution of hours of sunshine as represented by about 200 stations with records mostly covering the period of thirty years 1901–1930. This is in accordance with a recent change of policy whereby so-called normal values of the various meteorological elements based on the standard period of thirty-five years 1881–1915 have been discarded. The new policy aims at computing and publishing fresh averages for the preceding thirty years at the end of every lustrum of five years. It has latterly been realized that slow progressive or periodic changes of climate from one century to another may make the conception of standard normals rather meaningless. In the case of sunshine there is the further uncertainty due to changes caused by human agency such as the expansion of towns, smoke pollution or smoke abatement, which affect the duration as measured from the charred cards of the Campbell-Stokes Recorder.

The figures show a fairly regular decrease in the amount of sunshine from south to north in the British Isles, the range being from an average of five hours a day or 40 per cent. of the possible in the Channel Isles, the Isle of Wight, and other parts of the south coast to three hours a day or 25 per cent. in the Orkneys and Shetlands. The coasts tend to be sunnier than the inland districts, and the sunny conditions of the south coast of England extend farther north on the east coast than they do on the west, though the difference is comparatively slight. The figures for various London stations range about 30 per cent. of the possible, whilst in some industrial centres like Manchester they fall below 25.

It is interesting to note that whereas in the Channel Islands, below latitude 50° N., the percentage values for December and June are respectively 20 and 50, in the Shetland Isles, above latitude 60° N., where the days in midwinter are

more than two hours shorter and in midsummer over two hours longer, the corresponding figures are only 6 and 26. This indicates that meteorological conditions greatly enhance the darkness of the northern winter, and in summer despite the longer days diminish the daily amount of sunshine by about three hours in comparison with the south. It should be mentioned however that May in the Shetlands and Orkneys, with over 30 per cent., is the sunniest month both relatively and actually. The outstanding feature of the seasonal variation of sunshine in the British Isles is that the largest percentage of the possible occurs in the months around the summer solstice May to August, and the smallest in the months around the winter solstice November to February, the equinoctial months being intermediate. This fact enhances the contrast between the seasons: whereas in some climates cloudy summer and clear winter conditions cause a fairly even balance in the actual amount of sunshine experienced through the year.

Figures given for Malta indicate typical Mediterranean conditions, the percentage of the possible being as high as 51 in January, 82 in July, and 66 for the whole year.

FRENCH RURAL SETTLEMENT

An important contribution to the study of rural settlement has been made by Dr. O. Tulippe in his 'L'habitat rural en Seine-et-Oise' (No. 22 of the Travaux of the Cercle des Géographes liégeois). The area studied is that portion of the Paris basin in the Dept. of Seine-et-Oise lying to the west of the meridian of Versailles, and including portions of the natural regions of the Vexin français and the Beauce. Three communes are dealt with in considerable detail—Magny-les-Hameaux, on the plateau of the Beauce, Trappes, and Boissy-l'Aillerie, in the Vexin. After outlining the physical setting, he analyses in detail the present distribution, form, and size of the localities and isolated dwellings, before embarking upon an historical investigation of their evolution, with the object of arriving finally by synthesis at the "laws" of settlement. This has necessitated much research among national and local archives, much information being obtained from the "Atlas-terriers" of the eighteenth century. His study begins in the late Middle Ages, as at present the evidence for earlier centuries is not satisfactory. Before the Hundred Years' War, Magny-les-Hameaux well deserved its name, for there were some fourteen hamlets, each having about twenty to twenty-five labourers working 100 hectares. These hamlets were arranged regularly, about 1 kilometre apart. The area was devastated during the war, but had begun to recover by the first half of the sixteenth century, when there were twenty-seven inhabited places, due to the subdivision of the land and the rise of the "working farmer." The national economic policy however then led to a rural exodus on a large scale and the characteristic of the next century is the concentration of the land in a few hands. The nine ancient groups remaining, having a maximum of thirty houses, occupy, as would be expected, the most favourable sites. Trappes is an example of a single "agglomeration" which has persisted from the sixteenth century, alterations which might otherwise have been wrought by changes in land tenure having been checked by economic development on a route of importance. At Boissy the conditions have been intermediate.

The author shows in conclusion that areas of prolonged occupation are associated with small numbers of relatively large settlements, and more recent occupation with more numerous and smaller units, a conclusion, it may be noted, supported by Dr. Darby's researches in East Anglia. It is also apparent that, considered in relation to rural settlement, demographic fluctuations and

social and economic changes may at various times be either causes or effects. Physical conditions do not exercise an overriding control upon the evolution of forms, though their influence must not be rejected entirely. They act as often by repulsion as by attraction. At the epoch of the great medieval clearings, sites for settlement appear to have been selected without much regard to physical conditions, but during later changes readjustments have been made.

ADMINISTRATION OF THE FRENCH SAHARA

The recent pacification of southern Morocco and the western Sahara has led to the reorganization of the administrative system of the Protectorate. The official decrees giving effect to these changes are set forth, with a geographical commentary by Mons. J. Célérier in the *Revue de Géographie Marocaine*, January 1935. The administrative system is now in harmony with the physical and social characteristics of the country, ranging from the area of plains and low plateaux under civil control to the Saharan territories, where all power is concentrated in the military commander.

During the course of the military operations, a "Région militaire des confins algéro-marocains" had been provisionally established which comprised certain areas of Morocco, Algeria, and French West Africa, and aimed at co-operation between the three administrations in promoting security. This is now abolished, and replaced, as concerns Morocco, by the autonomous territory of Tafilalet with headquarters at Ksar-es-Souk, and comprising the circles of Rich, Aït-Moghad, Erfud, and Budenib. This covers the eastern portion of the "pre-Saharan" zone to the Algerian boundary: the remainder is controlled by the military districts of Agadir and Warzazat. The western Sahara falls within the new "Territoire autonome des confins du Draa," with administrative headquarters at Tiznit. The object of this division being the control of the nomadic tribes, the oases on the fringe of desert have been included: for example, on the east, the western portion of Tuat, on the north, the Bani, the area in the bend of the Wad Dra'a, and Taouz, frequented by the Aït-Khebbach. The southern boundary is indeterminate: under the Niamey Convention of 1909 the Sahara north-east of a line from the Rio de Oro boundary to Adrar was allotted to Algeria, that to the south-east to French West Africa. Thus, in the past, the control of the tribes of the Wad Dra'a region fell to Algerian forces, a situation in conflict with geographical conditions. The question of the boundary with Algeria is at present in abeyance. The existence of the Spanish territories on the west, affording asylum to raiders, has complicated the settlement: the establishment of the headquarters at Tiznit indicates that the control of this boundary and the protection of the communication with the south are now the main functions of this administration. Tiznit is also the most northerly market frequented by the nomads, and is on the "Air-France" route. In the south-east of this territory, Algerian *méharistes* from Tuat at the end of 1933 established contact at Terhazza with troops from Aruan, and later with a column from Mauritania. In the north-west, immediately following the occupation of Tinduf in March 1934, a motor convoy established contact at El Guerdane with the southern authorities from Chinguetti; in December two more columns carried out extensive reconnaissances in this area east of the Rio de Oro boundary, and established a permanent post at Bir Morhrein. To avoid the necessity of flights over Spanish territory, a landing ground has been made at Ain ben Tili.

EARLY MAPS OF SCOTLAND

In connection with its Jubilee, the Royal Scottish Geographical Society has published 'The Early Maps of Scotland,' by H. R. Inglis and others. The contributors have given much time to elucidating the history of the map

of Scotland, and the results of their research have been made available in papers in the *Scottish Geographical Magazine*, of which this handy list is to some degree a summary. The list is arranged chronologically, each entry giving the author, brief title, size, scale, and a note on the important features of the map. The outstanding names in the early history are Alexander Lindsay, if as seems probable he is to be credited with supplying the information upon which Lily's map was based, Timothy Pont, whose surveys were worked up by Gordon of Straloch and published by Blaeu, and John Adair, who initiated the more thorough surveys of the eighteenth century. A helpful feature of this book is the setting-out of the characteristics by which maps of Scotland may be assigned to their respective groups. Other valuable sections contain lists of town plans, and of historical maps.

Most of the maps, though by no means all, described are printed. Some passing remarks are made about portolan charts, but their value is not appreciated. It was also surely unnecessary to devote any space to combating the suggestion that they support the theory that Scotland was regarded as an island in the middle ages. One or two notes display some haste in the compilation. The sole reference to Ptolemy's maps contains the annotation "In Blaeu's Atlas, and many others." There is some doubt expressed as to the date of the larger of Bishop Leslie's maps of Scotland—"although dated 1578 it is thought to be 1586." Actually, there was a Rome issue of 1578, and a French reprint at Rouen in 1586. The statement that the plane-table "is said to have been invented in 1724 by J. Douglas" shows a lack of understanding of the early history of survey instruments. Sir Charles Close's work on the history of the Ordnance Survey is not mentioned, though there is a reference to his "Map of England."

These however are but small defects in a book which will be appreciated by all students of historical cartography, and not only of Scotland alone, as a work of reference. The eight line reproductions of important maps add greatly to its interest and value.

THE TECTONIC RELATIONSHIPS OF PLATEAUX

A paper by E. C. Andrews, entitled "The Origin of Modern Mountain Ranges. With Special Reference to the Eastern Australian Highlands" (*Journ. and Proc., Roy. Soc. New South Wales*, vol. 67, 1933 [1934], pp. 251–350), represents a chapter in the growth of an interesting hypothesis of mountain-building. An analytical description of the surface of the Earth as it is now, crammed into a hundred pages of print, makes difficult reading, but Andrews has succeeded in showing that the grander elevations and depressions are comparatively simple in general form. He sees no fundamental difference between existing plateaux and mountain ranges. Both, he thinks, are undulations in the crust of the geoid, due, within a given tectonic system, to the propagation of the same impulse through rigid and unstable material respectively. Explosive volcanic activity was associated with the "mountains" (intense folds), the outwelling of sheet-lavas (the plateau-basalts) with the "plateaux" (gentle folds). The broad simplicity of the scheme is illustrated by examples from the Andean, North American, Tethyean, and Australasian systems, though with a regularity that may be due to fortunate choice of the examples. That any degree of regularity is demonstrable at all however is the important thing; and, in spite of many difficulties the critic may discern, he will be forced to admit that Andrews' analysis of the state of major antecedent-drainage in elevated regions is in remarkable accord with a simple theory of almost contemporaneous undulation. For many years Andrews has been searching for evidence of an underlying unity

of control of geomorphological processes, in order to reconcile the difficulties of interpreting the geomorphology of the eastern Australian highlands ("Geographical Unity of Eastern Australia in Late and Post Tertiary Time, with Applications to Biological Problems," *Journ. and Proc., Roy. Soc. New South Wales*, vol. 44, 1910, pp. 420–480). If the plateaux behind or in front of the mountain arcs are really flat bulges of the crust, rather than flat-topped blocks bounded by faults, the unity of the general erosional processes, within the limits of major climatic provinces, necessarily follows. Andrews does not push the hypothesis too far. In particular, he is careful not to draw conclusions about the causes of mountain-building from the evidence of existing mountains alone. He notes that the underlying cause of late Tertiary diastrophism was world-wide; that the mountains rose by slow but saltatory movement; and he surmises that "the tendency to equilibrium, or balancing of crustal irregularities through the medium of a lower 'zone of flowage' and compensation is not a predetermining cause, necessarily, of mountain formation." His interpretation of plateaux is the distinctive feature of his hypothesis in its present state. If correct, it will simplify the problems of correlation in geomorphology. He is now engaged upon a study of the mountain-systems of earlier geological times. If his results harmonize with those derived from the work discussed here, new conclusions may be drawn with regard to some of the causes of mountain-building. He announces a paper on the "Growth of Continents." The statement of the hypothesis, in its present form, is unsatisfactory in two particulars: to regard mountains and plateaux as undulations of the geoid of different orders of magnitude, confuses the terminology of geology with that of geodesy; and to use the word "undulation" without explaining the exact sense in which it is used, leaves doubt as to whether wave-motion or wave-form is implied.

FRENCH COMMITTEE FOR HISTORICAL GEOGRAPHY AND HISTORY OF GEOGRAPHY

We have received from Dr. Y. M. Goblet the first number of the *Bulletin* of the newly formed French Committee for Historical Geography and History of Geography. This body is affiliated to the International Committee of Historical Sciences, and owes its formation to the impetus given to these studies by the French share in the cartographical exhibition held at the meeting of that body at Warsaw in 1933 (see *Geogr. J.*, vol. 84, p. 462). The Honorary President of the Committee is Prof. L. Gallois, and the President Mons. C. de la Roncière. Dr. Goblet, who is the General Secretary, contributes a short essay which sets out very clearly the scope of these studies, and the progress made in France and in other countries. His definition of historical geography resembles closely that generally held in this country, namely the reconstruction of the regional geography of the past, and he emphasizes the importance of cartographical material for this purpose, without overlooking the necessity for work in the field. The purpose of this bulletin is primarily to keep French scholars in touch with the work of their contemporaries, to promote co-operation, and to publish relevant bibliographical information. Though it is stated that the study of historical geography is not now encouraged in France, it is evident, from the list of one hundred and ten members, that it still attracts many students.

The formation of this body recalls the fact that two similar organizations are in existence, a commission of the International Geographical Union, which is preparing to publish the "Monumenta Cartographica Europica," and an International Commission of Historical Geography, which held a congress some years ago. It appears therefore that the subject is more likely to suffer from over-organization and duplication of effort than from neglect, and some degree of co-ordination would be welcome.

Annual General Meeting, 24 June 1935. The President, Major-General Sir PERCY COX, in the Chair.

The HON. SECRETARY (Mr. W. L. SCLATER) read the Minutes of the Annual Meeting held on 25 June 1934, which were confirmed and signed by the President.

In making the presentations the PRESIDENT said: We now come to the presentation of the Society's medals and awards. As you know, the two gold medals are of the same estimation. One is the Founder's Medal bearing the effigy of King William IV and the other the Patron's Medal bearing the effigy of the reigning sovereign.

The Patron's Medal this year is awarded to Mr. W. Rickmer Rickmers for his long and continued travels in the Caucasus and Russian Turkistan, culminating in his leadership of the Alai-Pamir Russo-German Expedition of 1928.

Mr. Rickmers' record of geographical exploration begins in the middle of the nineties of last century when he travelled in Transcaucasia and east Bukhara, ascended the mountains Karchkhal and Ararat, and wrote his paper for the *Geographical Journal* in 1899 "Travels in Bokhara." In the early years of the present century he renewed his exploration of these regions, led a party of twelve mountaineers to the Caucasus, and in 1906 made a very valuable journey in Russian Turkistan which was described in his well-known book 'The Duab of Turkestan,' published by the Cambridge University Press in 1913. In that year he went farther afield, exploring the glaciers of the Peter the Great Range in Karateghin and Darvaz on the fringe of the Pamir and discovered Carmo at the head of a party of eight. In 1914 he was planning another expedition in Central Asia with Mr. Douglas Freshfield, but the war intervened and interrupted his scientific work for many years. In 1928 he organized and led the greatest and most important of his expeditions—the German-Russian Expedition of twenty-two scientific men and twenty assistants to the Alai-Pamir. Their ascent of Kaufmann peak and measurement of the height of Mount Carmo are described with the expedition of 1913 in the *Journal* for September 1929, vol. 74, pp. 209–231. Especially important on this expedition was the photographic survey of the Pamir by Dr. Finsterwalder, who greatly developed the technique of photographic reconnaissance. Lastly, in 1932, Mr. Rickmers made an expedition to Lazistan which was described at the meeting of our Society on 14 May 1934.

Mr. W. RICKMER RICKMERS: After having thus complied with formality, I beg to be allowed to address you as dear old Royal Geographical. What was really at the back of my mind was, of course, "dear old thing," for you have been my wet nurse and my dry nurse these two score years. This token not only tells me that I have done my little bit, but for me it is also full of "Auld Lang Syne" and of the memories of forty years, from the day of Clements Markham and Scott Keltie. Of all the prizes coveted by the travellers of other nations the greatest by far are these Royal Medals. When I go over the long list of Gold Medallists, reaching back a hundred years, I feel honoured beyond merit and beyond compare. This means indeed the knighthood of geography, approved by your most gracious sovereign; and by a very fine stroke of fate I have been awarded the Patron's Medal in Their Majesties' year of Jubilee.

There is one who shares the honour with me, and that is my wife, British-born and my faithful companion in all my travels. We do treasure this medal, Mr. President. We shall, in fact, treasure it till our dying day.

The PRESIDENT: The Founder's Medal is awarded to Major R. A. Bagnold for his journeys in the Libyan Desert.

Major Bagnold is an officer of the Royal Engineers (now retired) and later of the Royal Corps of Signals, who during service abroad partly in Waziristan succeeded in spending his leave in perfecting the technique of desert travel by motor car. He then turned his attention to the Libyan Desert, and after several preliminary journeys he succeeded in 1929 in crossing the "Sand Sea" which had held up previous travellers and went west of Ain Dalla to within 10 miles of Rohlfs' route of 1874 (*Geogr. J.*, July 1931).

With the experience thus gained he carried out next year a much more extended journey. Having failed to cross the dunes to Kufara, he succeeded in crossing the unexplored area to the Gilf Kebir and 'Uweinat, making a good map on the scale of 1/Million (*Geogr. J.*, December 1931).

In 1932 he took an expedition to explore the Sarra triangle east of Tibesti and the country south of 'Uweinat up to the French frontier, an area which was at that time practically unexplored (*Geogr. J.*, August and September 1933. With important scientific appendices by different members of the party).

He was then sent out to China, and being invalided home devoted many months' enforced leisure to experiments upon the movement of desert sand, described in a remarkable paper to the Society at an Afternoon Meeting (*Geogr. J.*, April 1935).

All Major Bagnold's expeditions have been either related to us or recorded in papers in the *Journal*. His is a great record. Last year he was in China, but we are glad to see him back now in order to present to him his award.

Major R. A. BAGNOLD: Mr. President, I am exceedingly grateful for this honour which the Society has done me, and exceedingly proud. May I express my gratitude, too, for all the help and encouragement I have received from this House in the past: from Sir William Goodenough and yourself, from Mr. Hinks and the whole staff of the Society. Very many other people both at home and abroad have gone out of their way to help us; I would like specially to thank Dr. Ball, Mr. Murray and the officers of the Egyptian Desert Survey. Then there are my companions. I could have done nothing that I have done without them. Our expeditions were essentially collective ones; we pooled all our ideas, our gear and our expenses; in fact we formed a sort of private soviet. So I shall be proud to feel that this medal is a token of recognition of all their efforts as well as of mine.

The PRESIDENT: The Victoria Medal is not necessarily given every year, but when occasion demands, and it is mainly given for research in geographical matters. It is awarded this year to Mr. E. J. Wayland for his work on the Quaternary geology of Uganda and the Rift, and its relation to man.

For many years he has while directing the Geological Survey of Uganda with great ability devoted himself particularly to the study of the Rift Valleys, their structure, and their geological history. He laid the foundation for the striking work on the early history of man in East Africa by other workers. For sixteen years in opposition to the late Professor J. W. Gregory and to nearly all geologists, he has maintained that the Rift Valley is formed by compression and not by tension. It is gratifying to learn in the last few days that Dr. Bullard's measurements of the intensity of gravity in East Africa strongly support Mr. Wayland's theory, as we shall learn from a paper to be published shortly in the *Bulletin* of the Uganda Geological Survey.

Mr. Wayland is still in Africa, but Mr. Hobley has kindly come to receive the award on Mr. Wayland's behalf.

Mr. C. HOBLEY: It is a great privilege to me to come to-day at Mr. Wayland's

request to receive this splendid award. I have a letter from him in which he desires me to express, first of all, his deep appreciation of the award which this distinguished Society has granted him and also his eternal regret that his duty does not enable him to be present.

I feel rather strongly about the award to an old friend like Mr. Wayland, because I think that probably many in this room do not quite appreciate the fullness of its meaning to those who are hoeing rather a lonely furrow year after year in Central Africa. I remember many years ago when I was the fortunate recipient of one of the awards of this distinguished Society that it came as an entire shock. I was quite overcome by the fact that I had received some appreciation of a certain amount of work which I had been fortunate enough to do. I feel sure that Mr. Wayland would express his feelings much more eloquently than I can, but I do not wish to take up more of your time.

I however again thank you on his behalf and shall take measures to see that the award reaches him.

The PRESIDENT: The Murchison Grant is awarded on this occasion to Mr. R. P. Bishop for his surveys in British Columbia and other services to geography.

Mr. Bishop is one of the people to whom Mr. Charles Hobley has referred, because he has been working alone and unknown in British Columbia for many years. Some years ago, I think before the war, he was over in England and a good deal in the Society's building. Since then he has, as I say, been working alone, not neglected, but his work has not come much to notice. I heard from a friend in British Columbia recently that the award to Mr. Bishop of this Murchison Grant had been not only an enormous source of gratitude on the part of Mr. Bishop but also greatly appreciated by everybody who knew him in British Columbia.

For many years Mr. Bishop has devoted himself, sometimes in the service of the British Columbian Government, and sometimes on his own account, to the study of the intricate and difficult Coast Range, and has done as much as any man to resolve its problem and to determine the accurate heights of its mountains, particularly of Mount Waddington (*alias* Mystery Mountain of the newspapers) of which Sir Norman Watson gave us a film, and Commander Beauman read us a paper quite recently on what is known as the Fury Gap of the Waddington Range.

Mr. Bishop is still in British Columbia, but the Hon. Mr. Perry has been good enough to come here to receive the medal on Mr. Bishop's behalf. Mr. Perry is the Deputy Speaker of the House of Representatives, British Columbia.

The Hon. G. T. PERRY: Mr. President and distinguished Members, I can only regret that Mr. Bishop is not here to receive this award and acknowledge the great honour it is. I happened to be in London at this time. Mr. Bishop saw me before I left Victoria and requested me to attend here and receive the award on his behalf. We hold Mr. Bishop in very high regard and respect in British Columbia for the work he has done for so many years in connection with geography, and we consider that he has rendered honour to the province of his adopted country and also honour to the county of Devon, where he was born.

Mr. Bishop requested me to record to you in regard to Mount Waddington that he has recently discovered that the meaning of the Indian name for Mount Waddington can be interpreted as "the home of the winds." He is very anxious, as many others are, that the range of mountains there should be named the Albion Range in view of the association from the time of Drake and others. Mr. Bishop expressly impressed on me in a letter I received this morning to announce that to you to-day. On his behalf I thank you, and on behalf of the people of British Columbia I also thank you for the high honour which you have accorded him.

The PRESIDENT: The Back Grant is awarded to Mr. Wilfred Thesiger for his journey through the Danakil country, 1933–1934.

His paper in the early part of the present session will be fresh in the recollection of the Society. He started with a companion, Mr. Haig-Thomas, who is now with the Ellesmere Expedition, but he had to leave him because he contracted laryngitis. Mr. Thesiger continued and did a very courageous and fine piece of work, making a remarkable journey through exceedingly difficult and dangerous country, the Danakil country, which I knew something of about forty years ago, so I can appreciate the value of his journey. It was a great achievement for a young man to have accomplished that piece of geographical exploration before ever entering on his career in life.

Mr. Thesiger has now, we are glad to hear, passed into the Administrative Service of the Sudan and is in the Sudan region. The Honorary Secretary will take charge of the award and deliver it to him in due course.

The PRESIDENT: The Cuthbert Peek Grant is awarded to Mr. A. R. Glen for his work in Spitsbergen, particularly his leadership of the Oxford University Expedition, 1933.

Having won his spurs in successive Long Vacation expeditions he is now going to lead a very serious and important expedition of nine members, all with some scientific training which they hope to use in various directions of science. We can only wish him a very successful and valuable trip. He is going to North East Land, the north-east island practically of Spitsbergen. I now have pleasure in giving Mr. Glen the award for the work he has done in the past.

Mr. A. R. GLEN: I should like to express to you my very sincere gratitude for this award, and I would also like to say that most of the credit for it was due to the work of the seventeen other members who have been out on expeditions with me. I can only trust that the results the expedition which is to leave England in a fortnight's time hopes to obtain may justify the very great confidence which the Society have placed in me. I would like to thank you, Sir, for the continued support of the Society in this new expedition.

The PRESIDENT: The last award, the Gill Memorial, goes to Mr. E. E. Shipton for his plane-table surveys of the inner Nanda Devi basin, last year, and the neighbouring watersheds.

Mr. Shipton's account of his work on Nanda Devi, with his companion Mr. Tilman, made one of the best papers of the present session. He succeeded where all others had failed in penetrating the inner defences of Nanda Devi, and was first to set foot on the slopes of the mountain itself.

Dr. Longstaff, as you know, an experienced climber, said this was the best piece of climbing work that had been done for years; that it showed remarkably high mountaineering qualities, great resolution and very modest equipment: it was a shining example of how to do admirable work with small means. Mr. Shipton is now in command of the Mount Everest Reconnaissance party that left three weeks to a month ago and is now in Tibet. As you probably know, we are running the expedition which we have obtained permission to send again to make another assault on Everest, on different lines from the last three expeditions. We are sending out a reconnaissance party to look round the approaches to the mountain, especially in the west and, if it can, to see what the prospects of climbing Everest are after the monsoon. Mr. Shipton being where he is, the Honorary Secretary will receive the grant for transmission to him.

The PRESIDENT then delivered his Anniversary Address, which is printed on pp. 89 *et seq.*

The visitors having withdrawn, the PRESIDENT appointed Mr. H. St.J. B. Philby and Dr. L. J. Spencer to act as Scrutineers of the Ballot for the President and Council for the ensuing year.

The PRESIDENT, in submitting the Annual Report of the Council, said:

Ladies and Gentlemen, you will see that there is a deficit this year on account of the generous contribution that we made to the British Graham Land Expedition, which we hoped to provide for in budgets over three years.

I would like to emphasize the value of the gifts of Mrs. Yates Thompson and Mrs. and Miss Andrews who gave a fine collection of maps, while Mrs. Thompson gave a walnut show-case, now in the Library, for the display of her husband's gifts of ancient maps and books.

You will note that we have an Expedition Fund. We are badly off for ability to contribute to expeditions, and there are a great many going just now, especially of young University men. It is a very fine sign that there are so many who are anxious to explore and do really useful work. I have heard the complaint that it is not possible to do anything of very great value in a short expedition, but I can assure you that short expeditions are no picnics. The young men who go on them get bitten with the desire to explore and they go on to something better. You find that a young man who went on a short Long Vacation expedition this year will next year go into the Antarctic with a view to doing something very serious. So that you cannot neglect such expeditions. I do not know whether any one in the audience would like to make any observations on the Report. Otherwise I take it that you accept it.

The Report was unanimously adopted.

Mr. ST.J. PHILBY reported that as a result of the Ballot all the Candidates proposed by the Council had been unanimously elected by the Meeting.

The proceedings then terminated, the PRESIDENT *thanking Fellows for their attendance.*

THE ANNIVERSARY DINNER

The Anniversary Dinner of the Society was held at the Connaught Rooms on Monday 24 June 1935.

The President and Lady Cox received the company, which included, among the Guests of the Society: H.R.H. the Duke of Kent, H.H. the Maharaja Gaekwar of Baroda, H.E. the Norwegian Minister, H.E. the Minister of Emir Saud, the Hydrographer of the Navy, the Adjutant-General to the Forces, Air Chief Marshal Sir Robert Brooke-Popham and Lady Brooke-Popham, Lord and Lady Bledisloe, the President of the Royal Empire Society (Sir Archibald Weigall), the Deputy-Under-Secretary for the Colonies and Lady Shuckburgh, the Hon. H. G. T. Perry, Deputy-Speaker of the House of the Legislative Assembly of British Columbia, the President of the British Academy, Lord and Lady Rushcliffe, and Sir James Jeans.

After the loyal toasts had been honoured, H.R.H. THE DUKE OF KENT, in proposing the toast of the Royal Geographical Society, said: Mr. Chairman, I should like to thank you for the kind reception you have given me this evening, and I need hardly say how pleased I am to be at this dinner.

I have always been very fond of travelling, and it is a never-ceasing pleasure to me to see new countries and different peoples. I know I am not alone in enjoying this. Your Society is a very solid proof that many men and women have the same view.

It is said sometimes that the day of exploration is almost over, and that there are no new lands to discover. People who say that show how little of the world they have seen. I am sure that the more one sees of the world the more one realizes how much is still unknown.

The romantic days are over when a small band of men could sail straight into the unknown from an English port. Now we have wireless and the most elaborate forms of transport to help us, but there are still vast areas of the Earth's surface that remain unknown. Perhaps the best means of exploring these tracts is by air. From an aeroplane it is possible to see at a glance great expanses of country; it is also possible to cover great distances in a short time. The Everest flight is a case in point. Here the months required to approach Everest on foot were reduced to a few hours.

Just flying over a given area, though interesting enough, is however not sufficient in itself. A record must be kept, and for this purpose there is no better method than with the camera. Aerial survey is one of the very latest aids to the collection of accurate knowledge of the Earth's surface. It must not be thought that photographs from an aeroplane, and maps, are interchangeable terms. There are two distinct branches in the subject of aerial photography; that is to say, photographs may be taken with the camera either pointed vertically downwards or obliquely. Naturally, photographs taken vertically approach nearest to the ordinary map as we know it, but it cannot be said that a vertical photograph alone gives an accurate representation of any particular area of land. Anybody who has done much flying knows that from a certain height undulations in the ground become quite invisible, and therefore a photograph taken vertically, although it will give some idea of the country, and will include any remarkable or outstanding objects, may ignore completely important but less striking features.

The technique of plotting these vertical photographs and rendering them useful as maps is, I understand, very well developed, but very lengthy. From the explorer's point of view oblique photographs are far more valuable. Oblique photographs sometimes show entirely new features, as for example the southern face of Mount Everest, or the splendid waterfalls along the Kaieteur escarpment in British Guiana. These falls are situated in vast and unmapped forests; there are no surveyed ground marks, and not even the plan, still less the height, of the falls themselves can be determined with any accuracy.

It is not only from the point of view of the geographer that aerial photography is of great importance. The archaeologist, the miner, and the naturalist, among others, all use the aerial camera with great effect.

If I have spoken rather at length on the subject of aerial photography on a hot evening, I apologize, but I feel that this branch of the science of geography is one that will assume great importance in the next few years. When the British Graham Land Expedition returns I understand that it will have a great quantity of photographs of new territory. These photographs will prove invaluable in the hands of expert geographers.

In giving the toast of the Royal Geographical Society I should like to say that I hope the prosperity of its past will be increased in future years, and that the expansion of the work of the Society will be such that, among other things, it will be able to make full use of all the aerial photographs brought home by explorers from every corner of the world.

I now have much pleasure in giving you the toast, coupled with the name of the President.

The PRESIDENT, in responding, said: I think you will all realize how proud the Royal Geographical Society is to welcome a member of the Royal Family to its annual function. It is not the first time that H.R.H. the Duke of Kent has honoured us with his presence at our Annual Dinner, and since he did so in 1929 Her Majesty has done us the great honour of visiting the Society's building and has become a Patron of the Society with H.M. the King. So that we now

have Their Gracious Majesties as Patrons, H.R.H. the Prince of Wales as Vice-Patron, H.R.H. the Duke of Connaught as Honorary President, and we feel that we are indeed a Royal Society. The Duke of Kent has just been on a very interesting tour and it was partly that which we made the excuse, and partly also that this is the Jubilee Year dinner, for inviting him somewhat urgently to honour us with his presence. As a sailor the Duke of Kent can appreciate our points of view, for in his bringing up in the Navy he has had to do with many things that we are constantly concerned with. There is no doubt that that career is a very fine basis for any geographical interest or pursuit in after life.

Our Society is not a very rich society. We do all we can to give modest support to explorers going out and at the present moment, as I had the pleasure of enumerating this afternoon at our Annual Meeting, there are a very large number of expeditions going, ready to go, or coming back. To nearly all of those we have given our support in one way or another, either in small contributions or by the loan of instruments, and you will, I think, be surprised to know that we have instruments out on loan with these expeditions to the value of over £3000, which shows the extent to which we do our best to help small expeditions.

It is rather a curious coincidence that in 1929 when His Royal Highness dined with us the question of the assault on Everest was then before the public, and was the subject of some of the speeches on that occasion. Those who are not already in the know will be interested, I am sure, to hear that there is another expedition now in prospect. Since 1929—the occasion to which I have referred—we have had one expedition, in 1933, under Mr. Hugh Ruttledge, which most of you will remember. Now we are going to have another in 1935–36. Soon after the last expedition came home an earthquake occurred in Nepal, and the Dalai Lama, the head of the Tibetan Government, died suddenly. For both those reasons we feared it might be a long time before we were able to get permission to make another attempt, but, as I said in speaking of the subject at the time, the Everest Committee, of which the President of the Royal Geographical Society is Chairman, still hoped to pursue the ambition of the conquest of Everest and were only too ready to take advantage of any permission for another expedition. To our great surprise, this spring we received an intimation that if an application were made promptly we should in all probability be granted permission. We got permission in due course, but not quite in time to fit out a full expedition for this pre-monsoon period. As you know, the period in which any pre-monsoon expedition can make its preparations and get under way is a very short one. The party has to make their effort before June 15; and, so far as we know, it is not possible for an expedition to succeed after the monsoon. This year however we received permission for a whole year, so we decided to run the present expedition on rather different lines from those that have preceded it. We have sent out a small party under Mr. Eric Shipton, who was a member of the last expedition and who last summer, in order to keep himself fit, did a very fine piece of climbing in what is known as the Nanda Devi basin, the basin surrounding another very well-known peak, Nanda Devi, and he and six companions are now going to spend the pre-monsoon period in the precincts of Everest taking stock of its western approaches and, if possible, they will see what the conditions of the mountain are at the end of the monsoon. Then next spring we shall send out our main expedition.

As to the work of the Royal Geographical Society, we are going on in our leisured way. The past year has been a full one and this present year seems likely to be the same. We have had seven expeditions during the past year which have given us papers upon their results, and we have now two expeditions on the point of starting, one to Spitsbergen—a strong expedition under Mr. Glen, who

received one of the awards of the Society this afternoon—and another to East Greenland; besides which we have in operation an expedition in the north Polar Regions—a small one led by Dr. Noel Humphreys and organized by Edward Shackleton, the son of the great Shackleton, which is now back at Etah from Ellesmere Land awaiting a ship to bring them home. Judging from reports and telegrams, they have obtained very good results, having penetrated into Grant Land and discovered a new range of mountains, of an estimated average height of 10,000 feet, considerably to the north of the range known as the United States Range which it was part of their plan to cross. As for the British Graham Land Expedition, in the Antarctic, they are now in winter quarters and hard at work sorting the results of the previous summer and making plans for further work next spring.

Well, ladies and gentlemen, I talked to you a good deal this afternoon so I do not want to keep you now, but I can assure you that we are out to give all possible help to exploration and also to those aspects of human geography which undoubtedly are now getting hold of a great section of the public. I had the honour to be at the Geographical Congress at Warsaw in August last and I noticed there that the lectures on humanistic geography were especially popular and had large audiences. It is a direction in which there is a definite movement at this time and we wish to keep abreast of it and do all we can to further and encourage that element among geographers.

I should like in conclusion to mention that though there was not much that we could usefully do as a Society to express our devotion to Their Majesties during the Jubilee Celebration, situated as we are, away from the routes used during that period, we did our utmost to enter into the great spirit of the Jubilee. We had the building floodlit and we sent a dutiful address of homage and congratulation to Their Majesties. We are now much honoured by the presence of the Duke of Kent with us at our Jubilee Annual Dinner. I would like, if His Royal Highness will excuse me, to quote a few words from the Jubilee Lecture which Sir Halford Mackinder gave us, entitled "Progress of Geography in the Field and in the Study During the Reign of His Majesty King George the Fifth." The sentence struck me as being very appropriate and eloquent, it runs as follows: "For more than a century it has been the privilege of our Society to speed our explorers forth; to welcome them home; to reward them with honour, and in the performance of this function the Royal countenance and cooperation have been of inestimable value. They have raised the tone of our doings to a higher plane so that our honours become, practically, national honours." With those words, gentlemen, and an expression of our grateful thanks to His Royal Highness for his kind proposal of the Toast of the Society and his reference to me, I will close my remarks; but I have just two words of personal portent to add: one, to say how pleased I am to welcome my old friend the Gaekwar of Baroda here to-night. I was a young Political Officer in his State this time forty years ago and I always received the greatest kindness at his hands and those of Her Highness the Maharani. My wife and I always look back with happy memories to our time in Baroda. Secondly, I have to congratulate and assure him how very interested and glad we are to see our Trustee, Lord Zetland, in the highly responsible post of Secretary of State for India. We know from his long association with the Society what he is capable of, and we wish him every success in the very honourable but difficult position which he is now filling.

The Marquess of Zetland: The toast which I have been asked to propose is that of the Guests of the Society, and it must, I think, be flattering to our vanity to find that there are assembled at our board distinguished representatives of

almost every branch of human activity and every sphere of human culture. First and foremost H.R.H. the Duke of Kent and, if I may do so without laying myself open to the charge of impertinence, I would venture to suggest that in sallying forth as he did in his early years as a member of His Majesty's Navy he showed that he was the very embodiment of the spirit of our race. From Edinburgh to Capetown, from the Panama Canal to Pekin His Royal Highness has carried the flag. He has looked down from the air upon the Panama Canal; he has forced his way up that great artery the Yangtze River in the interior of China some 1500 miles to the Chinese town of Chungking, of which I myself have many memories but which I have not time to refer to now.

And then we have with us one of the most enlightened rulers of those great native States of India, H.H. the Maharaja Gaekwar of Baroda, a ruler whose friendship, I am happy to think, I may now claim during a period of many years. Then, my lords and gentlemen, turning west of Baroda we come to Arabia, that country which has proved so irresistible a magnet to the more adventurous among our explorers in recent years. Arabia is represented by H.E. the Minister of Emir Saud.

The Fighting Forces are, of course, represented, all three branches, by some of their most distinguished members: the Hydrographer of the Navy, the Adjutant-General to the Forces, and Air Chief Marshal Sir Robert Brooke-Popham. The Empire at large is well represented by the President of the Royal Empire Society, Sir Archibald Weigall, by the Deputy Under-Secretary for the Colonies, Sir John Shuckburgh, and by the Hon. H. G. T. Perry, Deputy-Speaker of the House of the Legislative Assembly of British Columbia, a part of the Empire of which I carry the happiest recollections, culled during a visit to it some two years ago.

Letters, of course, are represented by the President of the British Academy, and the science of Geology by the President of the Geological Society. Then again, man's acquisitiveness, or perhaps I should say man's aptitude for collecting objects, is represented by the Keeper of the London Museum, and curiosity in science by Sir Frank Smith, the Secretary of the Department of Scientific and Industrial Research. British statesmanship and politics, in the best meaning of the words, are represented by Lord Rushcliffe, better known to many of us perhaps as Sir Henry Betterton. Commerce is represented by the Governor of the Hudson's Bay Company; banking by Sir Austin Low, the Director of the National Provincial Bank; and I know we have astronomy represented by Professor Sir James Jeans. I always think that Sir James Jeans must look upon up geographers as the merest nonentities. After all, we explore merely the surface of this planet which, looked at through the eyes of Sir James Jeans, is a mere dot of dust in space. He explores more distant universes. If I remember rightly, in the way of Thomas Cook, he recently conducted a party of children to Mercury, Venus, Mars and other adjacent planets, but to Sir James Jeans a trip to Mercury or Venus or Mars is no more than to a Londoner is a trip from London to Brighton or Southend. What he really enjoys is to explore those island universes which exist in the infinite depths of space at distances from us not measured by miles or leagues but by light years, island universes which, if I rightly understood him, are speeding away from us at an incalculable pace; but that is nothing to Sir James Jeans. The faster they speed away from us the faster does he speed after them.

My lords and gentlemen, there seems to me to be one omission from the many branches of human activity represented at our board. I see here no representative of the teaching profession. That surely must be an oversight, for the Royal Geographical Society has recognized the importance of the teaching of

geography in the schools and universities of this country; and how necessary that teaching is still is clear in the answer given by a public school boy to a question addressed to him in a general knowledge paper in geography which ran as follows: "Describe and give the name of the river upon which Calcutta stands." The answer which certainly should have, though I doubt whether it did, received the greatest number of marks was this: "The river upon which Calcutta stands is a difficult river to negotiate. It is full of twists and turns, and it is for this reason that it is named by geographers the Googli."

My lords and gentlemen, I have exhausted the time at my disposal but I must add just one word about our two other distinguished guests whom I couple with this toast. First of all, H.E. the Norwegian Minister. May I say how happy and proud we are to find at our board so distinguished a representative of that country and that race which has so much in common with our own country and people, which has from all time sent forth its best men to explore the seas and which is joined to us not only by ties of sympathy but actually by ties of blood. The other name is that of Lord Bledisloe, a statesman who has recently returned from a period of office which has lent not only distinction to his name but distinction to the British Empire of which he is so conspicuous a member. Lord Bledisloe by his five years' administration in New Zealand has bound faster than ever the ties of friendship which bind that great Dominion to the Mother Country. We welcome him after his strenuous years of office and we offer to him and to Lady Bledisloe our best wishes for a period of happy repose.

With those words, ladies and gentlemen, I have much pleasure in submitting to you the toast of the Guests, coupled with the name of H.E. the Norwegian Minister and Viscount Bledisloe.

H.E. the NORWEGIAN MINISTER: Though I feel greatly honoured in being entrusted with the privilege of responding for the Guests on this occasion, I must confess that I have done nothing whatever to further the objects of the Royal Geographical Society. It can be said of your other guests that they have achieved this or that and that is why they are your guests, and rightly so. As I say, I have done nothing, but if it is a question of appreciation of your work and a feeling for the value of it, nobody can beat me. I, in common with others of the same nation as Nansen, realize what the Royal Geographical Society has done to increase knowledge of this beautiful earth of ours and to help towards improvement. Having been myself for many years a servant of the League of Nations, I can add that you have done much for humanity and the many problems that face the world as a whole. You have taught us, and you are continuing to make clear to us, that there is room for all, and that the riches of the earth are inexhaustible.

His Royal Highness has mentioned the technical facilities and they, of course, render your work easier and more efficient. I am convinced that in the days to come the Royal Geographical Society will achieve even greater success than it has up to the present. Situated, as the Society is, in the centre of the greatest Empire that the world has ever known, it is easier for you to send explorers out from your country which moreover has its political and economic tentacles spread all round the globe. On the other hand, your public are more clamorous for results. They want to know from year to year what you have done. That is why your guests to-night welcome the words your President has spoken with regard to your latest achievements and with regard to your problem for the future.

In deep gratitude and appreciation of the work of the Royal Geographical Society and with best wishes for its future success, I drink to your President.

VISCOUNT BLEDISLOE: The excellence of the dinner is only equalled by the warmth of your welcome. If my colleague the Norwegian Minister was somewhat embarrassed by having to reply for such a galaxy of scientific talent and eminence in various walks of life, I assure you I feel even more so and, indeed, I cannot imagine why I should have been chosen to represent the Guests in thanking you for your most lavish and friendly hospitality, unless it be that I have lately returned from a country which I can only describe as the gem of the overseas British Empire where, for the last five years, my wife and I have spent the happiest period in our lives.

I was interested to notice that my old House of Commons colleague, Lord Zetland, in proposing this toast, referred to the teaching of geography in the schools of this country. I do not know, of course, to what extent the Royal Geographical Society is responsible for this branch of elementary education, but I do most earnestly venture to hope that they will use their influence to try to persuade the British public that New Zealand is not part of Australia! I assure you that there is nothing that so distresses the New Zealander, with his great sense of patriotic independence, as being regarded as an infinitesimal part of the great Australian continent. I may even venture to remind you that when the itinerary of H.R.H. the Duke of Gloucester was announced in the British newspapers some—I will not venture to say which—included Auckland and Wellington in the Australian itinerary. But I esteem it a very great privilege to have listened to my old friend Lord Zetland proposing so eloquently the toast of the Guests at this banquet. It is seldom in this country that the head of a Government Department combines great ability with intimate and lifelong knowledge of the sphere of administration that he is called upon to rule. This certainly can be said of Lord Zetland. He has, as the President has pointed out, a most difficult task at a critical period in the history of the Empire and of India, but those of us who know him best realize that that task at such a time could not be placed in more efficient hands.

Well, now, His Excellency and I have this much in common: we are both associated with countries which Britishers visit in order to enjoy excellent fishing. I cannot deny that Norway presents greater opportunities to the ambitious and enterprising salmon angler than New Zealand does, but in every other branch of piscatorial activity I venture to say that New Zealand takes the lead. If any of you have any doubt upon that question I would venture to remind you that the Tongariro and other famous New Zealand rivers still provide the largest and most plentiful supply of rainbow trout to be found anywhere in the world, and if you really want to enjoy the most thrilling sport, as, by the way, H.R.H. the Duke of Gloucester has lately realized, try your luck at catching a sword fish ranging from 300 to 900 lb. in weight and watching him jump some 20 to 25 feet in the air about a quarter of a mile away.

But there is another form of fishing in which Norway is interested about which, with your leave, I would like to say a few words, and that is what is, perhaps, more an industry than a sport—whaling. Some in New Zealand have been a little anxious—that country being perhaps the chief base for the whaling industry of the world—lest, with these whale factory ships scouring the southern seas of the Pacific as well as Antarctic waters, the whales would be seriously depleted in the course of the next few years. I should like to congratulate the Norwegian Minister on the fact that his country has pointed the way to the reduction of the number of vessels employed in this industry and in the number of whales that they set out to destroy. Whether it is due to too plentiful a supply of whale oil and the consequent depression in its price I do not venture to suggest; but, however that may be, the whale is an animal which takes some time to

reproduce its species, and those who are interested in that monster of the ocean and in its due preservation will rejoice in the fact that the activities of the whale factory ships are to be substantially abated in the course of the next few years.

Well now, Lord Zetland, you have been good enough to refer to my own pre-consular activities in the most distant and the most British Dominion of the Crown—a country more British than Britain. But I do want you to realize that so-called success in pre-consular activity overseas is more objective than subjective, and is due, mainly in the case of those who represent His Majesty the King, to the abounding loyalty of our fellow subjects in the Antipodes and, to a very small degree, to any personal qualifications that his representative may possess. I would venture to suggest that there are only three essential qualifications for a reasonable degree of success as Governor-General of New Zealand, and I believe I possess them all! One is a good wife; the second is a love of sport; and the third is a smattering of agricultural knowledge, at any rate such as would enable one to differentiate between a turnip and a mangel-wurzel, and between a Merino and a Southdown sheep. It is a curious and interesting fact—and very few people realize it—that the one person above all others who ought to have some knowledge of the geography of New Zealand is its Governor-General, because there is no one else who has an equal opportunity of seeing every part of the country under the most favourable conditions. I am perfectly certain, and I am sure that no New Zealander will deny it, that my wife and I, without being in any sense experts, are better acquainted with the geography of New Zealand than any of its own inhabitants. With this knowledge I should like to testify to the fact—and I hope British tourists will realize it more and more as time goes on—that there is no more fascinating country in the British Empire than New Zealand; that it contains within a limited area a larger amount of varied scenic beauty than is to be found in any other area of similar extent in the world; that its sport of various kinds is at least as good as you will find in any other part of the British Empire, and that it possesses the most lovable and, as I believe, the most loyal people to be found in any Dominion of the British Crown. Of all the lovable and of all the loyal inhabitants of that Dominion none are more lovable or more loyal than the native Maori race; and, in conclusion, I want to ask all those present to develop, so far as they can, greater interest in that most attractive coloured people that inhabits the most distant Dominion of this Empire. I refer to them in particular to-day because, unfortunately, with the passage of time the number of European inhabitants of New Zealand who are acquainted either with the language or the mental outlook of the Maoris is rapidly decreasing, and indeed I believe that there are to-day only three people in the New Zealand Parliament, other than the four native members, who have any knowledge at all of the Maori tongue. Fortunately, Professor Macmillan Brown, who died recently, established by his will a most generous endowment which will enable some of the students of the constituent colleges of the University of New Zealand to learn the Polynesian languages and to develop a good deal of the Polynesian outlook upon life, which is so very different from our own, and which has to be studied and understood if we are going to govern the native races of the Pacific aright.

As greater shipping facilities are provided for visiting New Zealand and Australia there seems every chance of the tourist traffic becoming the most important and the most lucrative industry of New Zealand. H.R.H. the Duke of Kent referred just now to the great advantage of aircraft in facilitating access to some of the most attractive spots in the world. The development of aircraft for various purposes is going on apace in New Zealand, and the organized combination of ship, railway, road, and air in providing access to some of the most

beautiful spots in the world, such as are to be found in that most delectable country, promises to provide the tourist with facilities for seeing them which he has never enjoyed in the past.

I wish that I felt competent, on behalf of the very distinguished guests here to-night, adequately to express our appreciation of your hospitality, but so far as it lies in my power to do so I think I may say we have all spent a most enjoyable evening, thanks to your kindly hospitality.

Sir DENISON ROSS, in proposing the toast of the Medallists, said: It is no easy task to propose the toast of seven distinguished travellers in as many minutes, and I trust that I may not incur the displeasure of those whose toast I am proposing by trying to spare those who are going to drink it. You will many of you remember how in *Lady Precious Stream* each character on entry says who he or she is and why. Those who respond to this toast will I fear talk about anything rather than of themselves, and will give you no hint of what they have done. It is therefore my proud and pleasurable duty to tell you all about them as briefly as possible.

Those who devote themselves to exploration in remote and impenetrable regions run great risks and suffer many hardships, but I think it makes a great difference that they know nowadays—as they did not in the old days—that their movements are being closely and sympathetically followed by the scientific world and that when they come back they run a very considerable risk of receiving a gold medal or some similar award in recognition of what they have done, and recognition from the very critical body who have watched their movements and know exactly what they have done and what they have not done is of the kind that is most worth having. Those who have not the good fortune to return at any rate have their memories engraved for ever on this Society's roll of fame.

The Royal Geographical Society in distributing its prizes has in view not only the reward of those who have completed some great undertaking but also of encouraging those who are still engaged in exploration. This year's list includes recipients belonging to every country and, as usual, these awards have been made without regard to either nationality or speciality.

The Patron's Medal has been awarded this year to Mr. W. Rickmer Rickmers for his long and continued travels in the Caucasus and Russian Turkestan, and more especially for his leadership of the great Russo-German Alai-Pamir Expedition of 1928. Mr. Rickmer Rickmers is an old friend of our Society, having contributed an article to the *Journal* on Bokhara as long ago as 1899. He has divided his activities between the Caucasus and Russian Turkestan, but he is perhaps best known to us by his delightful book called 'The Duab of Turkestan,' which was printed by the Cambridge Press in 1913. I cannot resist the temptation of mentioning that in the travels which are the subject of that book, as in other travels, he has had as his constant companion Mrs. Rickmer Rickmers, who has been well known to many of us for many years as the author of an admirable book on 'The Chronology of Indian History,' published under her maiden name of Miss Mabel Duff. The German-Russian Expedition of 1928 took with it twenty-two scientific experts, and twenty other assistants, and carried out one of the most remarkable surveys ever performed. It is not for me to say anything about results, but I may mention in passing that Dr. Lentz, one of its members, made a special study of the high plateau on the road from Afghanistan to Kashghar, in order to determine the route probably taken by Marco Polo in the thirteenth century, and he had the opportunity, with the equipment and other resources available, of studying that question in a way in which no other traveller has ever had. I only refer to that as one of the very valuable features of this great expedition led by Mr. Rickmer Rickmers. Lastly,

in 1932 Mr. Rickmers made an expedition into Lazistan which was described, as some of you may remember, at a recent meeting of the Society.

I have to mention two other medals. The Founder's Medal has been awarded to Major R. A. Bagnold for his journeys in the Libyan Desert. For many years he made preliminary excursions into this desert, and in 1929 he succeeded in crossing the "Sand Sea" which had held up previous travellers. In 1932 he took an expedition to explore the Sarra triangle east of Tibesti and the country south of 'Uweinat up to the French frontier, an area hitherto practically unexplored. These expeditions were all made in the new ship of the desert, the motor car, which, with due precaution and care, can be made to perform feats which the camel cannot, though it does quadruple the risks. In a case of serious breakdown and shortage of food it has been found that a motor car is not so useful as a camel, that the spare parts even of a Rolls-Royce are not edible. Among the most remarkable results of these many expeditions has been Major Bagnold's very valuable studies of the movement of desert sand, and the April number of the Society's *Journal* contained an important article dealing with the fundamental problem of how and why sand accumulates instead of scattering haphazard all over the country. He will not tell you about this, I am sure, but it is a most fascinating topic and his lecture gave a very great treat to those who had the privilege of hearing him in the Society.

The Victoria Medal has been given to Mr. Wayland for his work in the Quaternary geology of Uganda and the Rift. The subject is highly technical, but it is connected with the early history of Man in East Africa, and reminds us of the close relationship of geography and history to which our President has already referred, a subject which is only now beginning to come into its own. Professor Trevelyan has re-written the history of England from this angle.

The Murchison Grant has been given to Mr. R. P. Bishop for his service in British Columbia. One of his chief problems was to determine the height of Mount Waddington, popularly known to the Press as Mystery Mountain.

The Back Grant has been awarded to Mr. Wilfred Thesiger, a name honoured in English history, for his perilous journey through the Danakil country of Abyssinia in 1932–34. The paper he read us last November has all the materials for a first-class thriller.

The Cuthbert Peek Grant has been awarded to Mr. Glen for his work on Spitsbergen and his leadership of the Oxford Expedition in 1933.

The Gill Memorial goes to Mr. Eric Shipton, of whom the President has already spoken, for the work he has done in the Nanda Devi basin and the neighbouring watersheds. We are pleased to know that he is now in charge of the reconnaissance expedition of the new attack on Mount Everest

I give you the toast of the Medallists of the Royal Geographical Society coupled with the names of Mr. W. Rickmer Rickmers and Major R. A. Bagnold.

Mr. W. RICKMER RICKMERS: I am sorry that I cannot do full justice to the kind words spoken by Sir Denison Ross, for I am deaf in both ears and was not able to hear what he said. At any rate, I thank him very much for what he said.

Of all the prizes coveted by the travellers of every nation the greatest by far are the Royal Medals of this Society. When I look down the long list of Gold Medallists reaching a hundred years back, I feel proud and honoured beyond my merit and beyond compare, for indeed this is the knighthood of geography approved by your most gracious Sovereign and, by the very special kindness of fate, the Patron's Medal has come to me in Their Majesties' year of Jubilee. I am most proud to be its recipient.

For forty years I have been a Fellow of this Society and for forty years the husband of a Scottish woman, who has been my faithful companion in all my

travels. My mind is, of course, full of reminiscences, and with your leave I will recount a short one more intimately connected with this Society through the popular personality of my old chum and one of your Vice-Presidents, Tom Longstaff, who has wisely absconded to-night, knowing what to expect from you.

The little sketch may be entitled "The Vice-President on High Jinks in the Caucasus." The scene is laid thirty years ago in the wildest province of the Caucasus. Imagine a broad valley full of virgin forest interspersed with green pasture here and there, and a grim village, built of granite, each house like a castle with a tower 30 or 40 feet high. Above all tower the grand peaks of the Caucasus, peaks of broken ice. Watch a cavalcade marching along, composed of many nationalities, among them your Vice-President-to-be. We approach the castle of the Prince, who receives us and at once causes an ox to be slaughtered on the lawn before us, and we shall not be allowed to leave until we have eaten it up.

When evening approaches and the descending sun touches the icy crowns of the mighty peaks we are led to the banqueting hall, a huge room with walls of rough-hewn stone. In one corner a big open fire at which an ox is being cooked. In another corner huge ox-skins filled with red wine. In the middle a banqueting table. There begins a carousal which lasts the whole night; among the carousers your Vice-President-to-be. First comes boiled ox head, followed by a gallon of red wine. Then a joint of the ox roasted, and again more red wine. Then a haggis of ox, followed by wine; and so it goes on.

Then the Prince lines up his retainers, rifle at shoulder and dagger at waist, and makes them sing the war songs of their race. Then the other nationalities give some of their songs—German, Austrian, Welsh, Scotch, and finally the Vice-President-to-be stands up and gives a choice selection of old English songs. I do not know if he ever had occasion at your functions to burst into song, but there I heard him. Among those I remember were "Knocked 'im in the Old Kent Road," "A Little Bit of Orange Peel," and "Ta-ra-ra-boom-de-ay," and, ever and anon, we all joined in the refrain of a famous Caucasian drinking song.

When the morning sun touched the icy crowns of the mighty peaks they seemed somehow to have doubled in number and the earth was swaying gently like a liner on an Atlantic swell. Then the Prince called his handmaidens to tuck us into bed, among us the Vice-President-to-be. When I awoke late at night Longstaff had already gone. He had sallied forth to conquer one of the last virgin peaks of the Caucasus, and one of the most difficult ones.

To cut short the long story of forty years, let me tell you again that to my wife and myself this is the proudest day of our lives; and let me assure you that I shall remain for ever mindful of the honour, the responsibility, and the duty resting upon the shoulders of a Gold Medallist of the Royal Geographical Society.

Major R. A. BAGNOLD: I, too, should like to begin by returning thanks for the Gold Medal I have received this afternoon. Little did I dream when my companions and I set out from Cairo ten years ago on our first trip into the desert that it would lead to this. Then, I must admit, I had hardly heard of the Royal Geographical Society and certainly did not know that the Society awarded gold medals. I was lucky. I learned enthusiasm for the desert from Colonel Stewart Newcombe, and I found amongst my friends kindred spirits to share the joys, the pleasures, and, last but not least, the expenses of travel.

I often think one can divide explorers into two kinds: the good linguists and the not so good linguists. The good linguist is, rightly, proud of his accomplishment. I envy him. He goes off by himself and mixes with strange folk. He records their strange customs and enjoys their anecdotes, printable or otherwise. He likes to feel at home among them. He travels with them and uses their local

means of transport. But there are others like myself who have not that blessed gift of tongues. Luckily for us, Providence has arranged quite large areas of the world where language presents no difficulties at all—because there are no people to talk to. We have the Poles and the great deserts to play about in—personally I prefer the deserts because they are warmer—but in both localities a different kind of expedition has evolved. We go out in teams instead of singly. We use whatever form of transport is most likely to serve our purpose best, regardless of custom or tradition. We have even been known to use motor cars and aeroplanes. I have a feeling that some people still call that cheating, but I do not agree. After all, the object is to go and find out, and I think one should use all the means in one's power to get there to find out. There is a difficulty, though—it may have occurred to you already—in exploring uninhabitable places. There is apt to be precious little except empty space to be found when one does get there, or so it appears to the ordinary traveller. He starts with a blank map. He employs the approved methods of navigation so nicely set out in 'Hints to Travellers.' He draws a line with extreme accuracy across the map to mark his route. Perhaps he writes notes across it: "Very soft sand," or "Open rolling country," or, alas, still more frequently, "Featureless country but very good going"; and at the end it remains a blank map. But that is not all. He comes home, and, to add to his discomfiture, it is proclaimed to the world that he has been out looking for a fairy castle in a mythical oasis. Sometimes though he is fortunate enough to go that way again in the company of a specialist—say, an archaeologist or geologist. At first he is annoyed because the man will insist on stopping, just when the going is particularly good and the car is going particularly well, to grub about amongst the stones, but soon he becomes amazed at the fascinating things to be found everywhere, things he would not have thought of looking for if he had been left to himself. Whole new fields of exploration seem to be opened up.

And that, I think, points to the future of exploration: the days will come when the ordinary traveller can no longer discover any new and exciting geographical feature because there will not be any left. But as knowledge becomes more specialized there will always be new things to be found by those who know what to look for, even in ground that has already been gone over. The only trouble is to persuade the specialist to leave his books and lectures and come out into the field. And that is where the motor car comes in. It saves time and therefore makes is possible for the specialist to come and take part.